

SPECIAL PROVISIONS

FOR

BELLA VISTA DETENTION BASIN PROJECT COCHISE COUNTY, ARIZONA



PREPARED FOR:

COCHISE COUNTY ENGINEERING &
NATURAL RESOURCES DEPARTMENT
1415 MELODY LANE, BUILDING F
BISBEE, ARIZONA 85603

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SECTION 101 – ABBREVIATIONS AND DEFINITIONS

101.1 – ABBREVIATIONS:

Add the following abbreviations:

NTP	Notice to Proceed
QC	Quality Control
QA	Quality Assurance

101.2 – DEFINITIONS AND TERMS:

Add the following definitions:

1. Add to the definition of the phrase “Construction Documents,” the phrase “Supplemental General Conditions”. The terms “Contract Documents”, “Design Plans”, “Plans”, and “Construction Documents” shall be used interchangeably throughout these specifications.
2. Revise “Contract Documents” as follows: The Contract Documents consist of the Contract, the Final Plans and Special Provisions, Addenda, if any, Maricopa Association of Governments (MAG) Standard Specifications and Uniform Standard Details, latest revisions thereto, Cochise County Road Design & Construction Standards & Specifications For Public Improvements (County Specifications (CCS) Section D Typical Sections & Details, and Section E; Standard Specifications), the Contractor’s Proposal, Bid Item Schedules, Affidavits, the Performance Bond, the Payment Bond, Certificates of Insurance, the Certificate of Performance, Verification of License, No Collusion Certification, the Subcontractor List, the Subcontractor Selection Plan, the Safety Plan, the Supplemental General Conditions, government-required forms, documents incorporated by reference, any supplemental agreements that are required to complete the construction of the work in an acceptable manner, and Change Orders (if any), all of which constitute one instrument. The terms Contract, Construction Documents, Contract Documents and Construction Services Contract are used interchangeably unless the context clearly indicates to the contrary.
3. Revise “Contractor” as follows: The individual, partnership, firm, corporation, or any acceptable combination thereof, or joint venture, contracting with the Owner for performance of the work.
4. Change the definition for “Engineer” to the following: The person or engineering firm retained by the Owner acting as the Owner’s authorized Engineer for the construction of the Project at a particular location.
5. Change the definition of the term “Owner” to the following: Cochise County Engineering & Natural Resources Department, acting through its legally constituted officials, officers, or employees.
6. Whenever the word “County” is used in these Specifications, it shall mean the Cochise County Engineering & Natural Resources Department.

END OF SECTION

SECTION 104 – SCOPE OF WORK

104.1 – WORK TO BE DONE:

104.1.1 – General:

Add the following to the first paragraph:

Intent and Purpose

The work performed and materials used in this project shall be in accordance with Cochise County Road Design & Construction Standards & Specifications For Public Improvements (County Specifications (CCS) Section D Typical Sections & Details, and Section E; Standard Specifications), the Uniform Standard Specifications and Details for Public Works Construction, sponsored and distributed by the Maricopa Association of Governments (MAG). The intent and purpose of these Special Provisions is to interpret, correct, modify, and supplement the CCS and MAG Specifications to the extent and in the manner specifically referred to, and to provide additional Specifications. The Standard Specifications, together with these Special Provisions, shall constitute the Contract Specifications for this project.

An electronic copy of the CCS can be found at the following link:

<https://www.cochise.az.gov/DocumentCenter/View/785/Road-Design-and-Construction-Standards-and-Specifications-for-Public-Improvements-2017--PDF>

Project Description and Location

These Special Provisions provide additional guidance and specifics for the construction of the Bella Vista Detention Basin Project near Sierra Vista, Arizona. The project is located approximately 9,000 feet east of the East Charleston Road – East Dake Road intersection. The proposed basin is located on parcel 107-01-001A owned by Cochise County within a portion of Section 27, Township 21 South, Range 21 East of the Gila and Salt River Meridian.

The projects include installation of roller compacted concrete, riprap, channel grading, and excavation of an existing material extraction gravel pit. The work performed and materials used in this project shall be in accordance with the 2024 Uniform Standard Specifications and Details for Public Works Construction, sponsored and distributed by the Maricopa Association of Governments (MAG). These Special Provisions are applicable to the plans prepared by JE Fuller (Construction Drawings) and serve as a supplement to the MAG Standard Specifications and Details for Public Works Construction.

It shall be the Contractor's responsibility to complete the work specified here within and supply any incidental services or accessories necessary to make the work complete and perfect in all respects and ready for operation. Any apparatus, appliance, material, or work not mentioned in the Specifications, or vice versa, or any incidental appurtenances necessary for the system to operate as to the intent of these Specifications, even if not particularly specified, shall be included in the bid price and furnished, delivered, and installed by the Contractor without additional expense to Cochise County.

All construction activities will occur in an area that is subject to flooding. Flows can occur at any time and the Contractor must anticipate and manage construction activities during storm events. The Contractor will remove all equipment from the construction area whenever flows could occur that would inundate the equipment or equipment storage areas. Protection from flooding of Contractor's equipment and construction items to be furnished by the Contractor is the Contractor's responsibility.

The Owner and Contractor shall have pre-activity meetings at times agreed upon during the pre-construction meeting. These pre-activity meetings shall be held prior to all major work elements. The Engineer's approval shall be obtained before commencing work.

104.2 – ALTERATION OF WORK:

Add the following:

Any deviation from the approved plans and specifications shall require a change order from the County. No deviation from the approved plans and specs shall be implemented without prior approval from all applicable parties and/or regulators.

The Contractor's bid and all cost estimates or pricing proposals required or permitted under this section shall be itemized to include direct labor by man-hours, individual craft, hourly wage rate and verifiable labor burden. Other direct costs shall include rental and operator rates for rented or owned equipment, material trucking expenses and other costs clearly identified and directly allocable to contract performance. Material costs shall be itemized by item description, quantities for each item, unit price per item, including applicable sales tax markup, and extended total price per item. The Contractor shall provide copies of material supplier quote sheets, invoices or purchase orders, as appropriate. In the case of a conflict between the unit price and the extended total for a specific item, the unit price will govern.

END OF SECTION

SECTION 105 – CONTROL OF WORK

105.3 - CONFORMITY WITH PLANS AND SPECIFICATIONS:

Add the following:

105.3.1 – Substitute Construction Methods or Procedures:

If a specific means, method, technique, sequence, or procedure of construction is shown or indicated and expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to the Engineer. Contractor shall submit at least two (2) weeks prior to construction sufficient information to allow the Engineer, in Engineer's sole discretion, to determine if the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by Engineer will be similar to that provided in subparagraph 106.4(B).

105.4 - COORDINATION OF PLANS AND SPECIFICATIONS:

Add the following:

105.4.1 – Applicable Standards:

Throughout the contract documents, reference is made to codes and standards, which establish quality, type of workmanship, materials, and establish methods for testing and reporting of pertinent characteristics. Where materials or workmanship are required by the contract documents to meet or exceed the specific code or standard, it is the Contractor's responsibility to provide materials and workmanship complying with the contract documents. Specific naming of the codes or standards occurs on the working drawings and sections of the Specifications. It is the Contractor's responsibility to verify the requirements of the specific codes and standards and to produce items which meet or exceed the specified requirements.

The Project Engineer reserves the right to reject any Contractor installed items which fail to meet the specified minimum requirements, or to accept non-complying items, subject to an adjustment of the contract sum.

The work shall also conform to such drawings, including explanation of details or minor modifications, as may be furnished from time to time during construction, including such minor modifications as the Project Engineer may consider necessary on account of conditions found during the prosecution of the work. Scaled dimensions shall not be used in the construction of the work.

105.4.2 – Proposal Quantities:

Add the following:

It is expressly understood and agreed by the parties hereto that the quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated as stated in the Bid Schedule, are only approximate and are to be used SOLELY for the purpose of comparing, on a consistent basis, the bids offered for the work under this Contract. The Contractor further agrees that the County shall not be held responsible if any of the quantities are found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done. If any error, omission, or misstatement is found to occur

in the estimated quantities, the same shall not invalidate this Contract or release the Contractor from the execution and completion of the whole or any part of the work in accordance with the Project Specifications and Contract Documents and the Construction Plans herein mentioned, or for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation except as may be provided for in this Contract.

105.5 - COOPERATION OF CONTRACTOR:

Add the following:

The Contractor is required to meet all current, and applicable regulations of the Occupational Safety and Health Administration. The Contractor shall bear full responsibility for compliance with all applicable Federal, State, and local laws and regulations.

105.5.1 – Pre-Construction Meeting:

Add the following:

After award of the contract and prior to the commencement of the work or mobilization, a pre-construction meeting shall be scheduled at a location and time (prior to mobilization and start of construction) to be agreed upon between the Owner and the Contractor. The Contractor shall make all necessary arrangements to have key personnel of the Contractor's company and of the Contractor's principal subcontractors present at the meeting. Each representative shall have authority to make commitments and act on behalf of their firm or company. The purpose of the pre-construction meeting is to discuss any specific concerns or potential problems that the Contractor is aware of, to provide general information appropriate to the contract, to identify responsible individuals for various functions within each organization, and to develop tentative dates for the start of construction. The Contractor shall submit to the Engineer during the pre-construction meeting the following documents (both electronically, and paper copies) as available:

1. Preliminary work schedule/sequence of construction
2. Preliminary traffic control plan and Contractor Contact Information
3. Emergency telephone numbers
4. Signing authority letter
5. Name and telephone number of the certified safety professional
6. Preliminary copies of the NOI and SWPPP per Subsection 107.2.1
7. Qualifications outlined in Subsection 105.6
8. Estimated billing schedule
9. Shop drawings
10. Manufacturer's certification for all materials
11. Material data safety sheets
12. Preliminary survey layout, staking, and excavation plans.
13. Contractor pay item cost breakdown as noted in the Special Provisions

The pre-construction meeting will cover topics such as the quality testing requirements, critical elements of the work schedule, document control and electronic record keeping. Additionally, a scheduled start date for the work will be determined.

The Contractor shall be responsible for taking minutes of the pre-construction meeting and for distributing copies to all meeting participants. The meeting minutes shall be distributed within forty-eight (48) hours of the meeting. At the subsequent construction progress meeting, the minutes will be attested or revised, as appropriate. The cost for attendance at the pre-construction meeting and preparation and distribution of meeting minutes shall be incidental to the Project and no extra payment will be made.

105.5.2 –Construction Progress Meetings:

Add the following:

Construction progress meetings shall be scheduled weekly, or as considered necessary by the Owner. The Contractor shall make all arrangements to have key personnel of the Contractor's company and of the Contractor's principal subcontractors present at all progress meetings; representatives shall have authority to make commitments and act for their respective firm or company. The Contractor shall assume full responsibility to act for and commit any subcontractor employed by the Contractor, whether or not such subcontractor is represented at the meeting.

During the construction progress meeting, the Owner's representative will act as chairman and will advise the Contractor of any administrative matters connected with the contract. The Contractor shall submit for review the Contractor's two-week rolling schedule. The Contractor's representative at these meetings shall be prepared to discuss and resolve construction problems and concerns, material delivery, vendor data submittals status, construction progress as measured against the Contractor's approved construction schedule and the Contractor's short range construction activities as provided on the Contractor's two-week rolling schedule. The Contractor shall not be relieved of the Contractor's responsibility to fulfill all of the terms of the contract as a result of any inferences drawn or suggestions made available at these meetings.

The Contractor shall be responsible for taking minutes of the construction progress meetings and distribute copies to all meeting participants. The meeting minutes shall be distributed within forty-eight (48) hours of the meeting. At the subsequent construction progress meeting, the minutes will be attested or revised, as appropriate. The cost for attendance at meetings and preparation and distribution of meeting minutes shall be incidental to the project and no extra payment will be made.

105.6 - COOPERATION WITH UTILITIES:

Add the following:

Whenever any work is scheduled which may affect a utility, the Contractor will be required to give the respective utility Owner sufficient advance notice so that the Owner may provide a representative to prevent damage to the utility. The following utilities are known to have facilities in the area of the construction:

Sulphur Springs Valley Electric Cooperative, Inc. (Electric)
CenturyLink (Telephone)

Utility locations shown on the plans are approximate, and all utilities are not necessarily shown. The possibility of conflicts with existing utilities in service exists, although they are not anticipated to be in conflict. All work at or in close proximity to said lines shall be performed in accordance with all Federal, State, and local laws and regulations, including but not limited to:

- (1) Arizona law regarding "High Voltage Power Lines and Safety Restrictions" (A.R.S. 40-360.41-.45).
- (2) The Occupational Safety and Health Administration.
- (3) The National Electric Safety Code.

It is noted, that there are overhead power and communication lines within the project area. The Contractor shall contact Blue Stake and provide written notice to the utility owner a minimum of 14 calendar days in advance of any need for overhead protection. The contractor will be responsible for protection of utilities facilities.

105.8 - CONSTRUCTION STAKES, LINES, AND GRADES:

REMOVE in its entirety and REPLACE with the following:

All surveying required for the construction of the work shall be the Contractor's responsibility. The Engineer will not set any construction stakes or perform any construction-related surveying. No work shall be done without lines and grades having been established by the Contractor. The County will furnish a Benchmark, which the Contractor will use to set line and grade for all construction. Contractor responsibilities under this subsection include the following:

- A. Record Drawings will be prepared by the Engineer of Record utilizing red-line working drawings maintained on the project site by the Contractor. These paper red-line working drawings shall be maintained by the Contractor in a current condition at all times and updated at least weekly until completion of the work and shall be available for review by the Engineer and the Engineer of Record at all times. A formal review of the status of the red-line drawings will be conducted monthly just prior to compiling the contractor's payment estimate. A color copy of the final red-line working drawings shall be provided by the Contractor to the Engineer prior to close out. Final acceptance may be delayed if it is found that the red-line working drawings are incomplete or inaccurate, and until appropriate corrections are made by the Contractor to the red-line working drawings.
- B. Final surveyor as-built drawings sealed by a Land Surveyor registered in the State of Arizona shall be provided by the Contractor to the Engineer for review and approval prior to close out. Final acceptance may be delayed if it is found that the surveyor as-built drawings are incomplete or inaccurate, and until appropriate corrections are made.
- C. Prior to close out, the Contractor will be required to provide the Owner a 3D CAD file in a standard *.dwg format, for review and acceptance by the Engineer.

For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the Contractor's approved construction schedule. Payment of the lump sum contract price will constitute full compensation for completion of all work under this pay item.

Payment for survey shall be made at the lump sum bid price and shall include all materials, labor, equipment, maintenance, and any incidentals thereto, in order to complete the work in accordance with the Construction Drawings and Specifications for this project.

END OF SECTION

SECTION 106 – CONTROL OF MATERIALS

Add the following:

106.1 - SOURCE OF MATERIALS AND QUALITY:

On all questions concerning the acceptability of materials, machinery, and classification of material, execution of the work, conflicting interest of Contractors performing related work, and the determination of costs, the decision of the County Purchasing Manager shall be final and binding upon all parties, based upon review of justification and recommendation of the Project Engineer and/or the Project Inspector.

Materials used on this project shall meet all quality requirements of the Contract. In order to expedite the inspection and testing of materials, the Contractor shall notify the Project Engineer of the proposed source(s) of supply before delivery is started. If it is found after trial that sources of supply for previously approved materials do not provide specified products, the Contractor shall furnish materials from another approved source, pay for any failed tests on previous material, and pay any additional costs for testing to approve another source all at no additional cost to the County.

All materials to be incorporated into the work shall be subject to sampling, testing, and approval by the County. The Project Engineer, or his designated agent, shall select samples of materials proposed by the Contractor to be used for the project. It is understood that the County reserves the right to retest all materials, prior to their use in the project, upon delivery. All materials and/or equipment shall be handled in such a manner as to preserve their quality and fitness for the work.

Additional tests required due to failure of the initial or normal test(s) or any tests that the Contractor feels are necessary for the proper completion of their work, shall be paid for by the Contractor. Any testing not directly requested and location specified by the County shall also be paid by the Contractor. The Project Engineer, or his designated representative, shall indicate when and where all tests shall be taken. The Project Engineer shall approve the laboratory which will accomplish all materials testing. The Contractor shall be responsible for any standby time once the testing technician has been scheduled and is on the job site.

The procedures and methods used to sample the test materials shall be determined by the Project Engineer. Unless otherwise specified, samples and tests shall be performed in accordance with either the standard methods of AASHTO, ASTM, or ADOT, which were in effect and published at the time of advertising for bids.

106.5 - STORAGE OF MATERIALS:

Add the following:

106.5.1 – Contractor Access:

The Contractor shall have rights to access those lands shown in the plans as being within the Project boundary. The Contractor shall not use private property to access the Project area without first obtaining written permission of the property owner and providing evidence of such permission to the Engineer. The Contractor shall have the right to use “designated access routes” outside of the Limits of Construction as designated on the plans.

END OF SECTION

SECTION 107 – LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

Legal regulations and responsibility to public shall conform to Section 107 of the MAG Uniform Standard Specifications, except as modified herein.

107.2 PERMITS:

Replace with the following:

The Contractor shall obtain all permits and licenses, including but not limited to those required by the State of Arizona, Cochise County, U.S. Government, and any local or federal agency with jurisdiction within the project area, and shall pay all charges, fees, taxes, and provide all notices necessary and incidental to the due and lawful prosecution of the work. Permits for earth moving may be obtained from Cochise County. It is the responsibility of the Contractor to verify permit application fees.

In particular the Contractor shall prepare a Storm Water Pollution Prevention Plan (SWPPP) and obtain all necessary AZPDES and SWPPP permits as required and in accordance with subsection 107.2.1. Copies of these permits and any addendums shall be provided to the Engineer no later than seven (7) calendar days after issuance.

107.2.1 - AZPDES Permit Requirements:

Add the following:

This project is subject to the Arizona Pollutant Discharge Elimination System (AZPDES) storm water requirements for construction sites under the Arizona Department of Environmental Quality's (ADEQ's) Construction General Permit for Arizona. Under provisions of that permit, the Contractor shall be designated as permittee, and shall take all necessary measures to assure compliance with the AZPDES General Permit for Arizona as well as all other applicable Federal, State and local laws, ordinances, statutes, rules and regulations pertaining to storm water discharge. As the permittee, the Contractor is responsible for preparing, in a manner acceptable to the ADEQ, all documents required by this regulation and adhering to its regulations throughout construction.

Payment for SWPPP plan preparation, Dust Control and AZPDES/SWPPP permit acquisition and maintenance shall be made on a lump sum basis for all work that is associated with installation and maintenance of the SWPPP and dust control measures during project construction, including assuring proper operation of the pollution control devices installed, and all maintenance, cleaning, and disposal costs associated with clean-up and repair following storm events, runoff or releases on the project. Re-vegetation of ALL disturbed areas EXCEPT channel bottoms shall be in accordance with Section 430.0 of these Special Provisions.

107.10 - CONTRACTOR'S RESPONSIBILITY FOR WORK:

Add the following:

- A) The Contractor shall maintain dust control measures at all times during the construction of the work. The Engineer reserves the right to direct the Contractor to maintain dust control measures.
- B) Contractor is advised that the work will be subject to stormwater flows of water of varying amounts. Owner assumes no responsibility for notifying Contractor of any anticipated flows, nor for any

damages incurred by Contractor to equipment or to any of the Contractor's work as a result of any flows of water.

- C) The Contractor shall take all necessary action to protect the public from the construction work area. The Contractor will also notify the Engineer of any unauthorized personnel in the project area, including the presence of the general public.
- D) The Contractor will notify the Engineer immediately of any significant differences between ground topography shown on the construction drawings and existing ground topography which may cause there to be additional cut or fill requiring the approval of the Engineer.
- E) Pollution control management shall be provided by the Contractor consisting of installation of measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities. All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition. No separate payment will be made for the items discussed herein.
- F) The Contractor shall not remove any vegetation, plants and/or trees not specifically called out for removal or outside the limits of construction as shown on the Plans.
- G) Where existing fences are to be removed, the Contractor shall provide temporary fencing.

END OF SECTION

SECTION 108 – COMMENCEMENT, PROSECUTION AND PROGRESS

108.1 - NOTICE TO PROCEED:

Replace paragraph (A) with the following:

The Contractor shall commence work within fourteen (14) calendar days after the Notice to Proceed. All work shall be entirely completed within **one hundred and twenty five (125) calendar days** beginning with the date specified in the Notice to Proceed unless instructed otherwise by Cochise County. Work shall be deemed complete when the Engineer makes the final acceptance pursuant to General Condition 105.15, which neither the Engineer nor the Owner shall unreasonably withhold or delay.

108.4 - CONTRACTOR'S CONSTRUCTION SCHEDULE:

108.4.1 - Contractor's Billing Schedule:

Add the following:

The Contractor shall furnish the Engineer an Estimated Billing Schedule, which shall include the estimated amount of each billing for the total work at the pre-construction conference, and thereafter at monthly intervals as agreed to between the Contractor and Engineer.

108.5 - LIMITATION OF OPERATIONS:

Add the following:

The normal workweek shall be forty (40) hours, Monday through Friday, and the work hours will be determined at the pre-construction meeting. This does not imply that this contract can be completed on time utilizing normal working hours. The Contractor shall furnish sufficient forces and shall work such hours including overtime operations as necessary to ensure the completion of the work within the time required. **No night work will be allowed on this project unless approved by the Engineer.** Night work is defined between the hours of 7:00 PM and 5:00 AM.

END OF SECTION

SECTION 201 – CLEARING AND GRUBBING

Clearing and grubbing shall conform to Section 201 of the MAG Uniform Standard Specifications, except as modified herein.

201.1 DESCRIPTION:

Add the following:

This work consists of the removal and disposal of all vegetation including shrubs, trees of all sizes, and other plants within the limits of construction for this project as indicated on the Plans. Clearing and grubbing shall be performed within the limits of work only, including borrow areas, excavation limits, fill zones, access roads, and other areas delineated on the Plans.

Clearing and grubbing shall be performed in advance of grading operations. Prior to starting clear and grubbing the Contractor must verify the location of existing utilities that may be damaged during this work.

201.5 PAYMENT:

Replace with the following:

Clearing and grubbing shall be paid for at the bid price per acre, which price shall be full compensation for labor, materials, services, equipment, clearing, disposal, and staking as shown on the Plans and per these Special Provisions.

END OF SECTION

SECTION 202 – MOBILIZATION

Add this section to the MAG Uniform Standard Specifications

202.1 DESCRIPTION:

The work under this section shall consist of preparatory work and operations, including but not limited to, the movement of personnel, equipment, supplies, and incidentals to the project site; the establishment of all offices, buildings and other facilities necessary for work on the project; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and for all other work and operations that must be performed and costs incurred prior to beginning work on various items on the project site.

202.3 CLEANUP:

Contractor is responsible for cleanup of the site daily during construction and upon completion of the work. Cost of cleanup will be considered incidental to the project and no separate payment will be made for cleanup.

202.4 MEASUREMENT:

Evaluation of measurement for payment for mobilization shall be based on equipment and materials delivered to the site and the level of work being accomplished commensurate with the scope of work.

202.5 PAYMENT:

Mobilization will be paid for by the Lump Sum with 50% of the Amount Bid Payable with the initial application for progress payment and the remainder to be split evenly among all additional progress payments. Retainage as specified will be applied to Mobilization.

END OF SECTION

SECTION 211 – FILL CONSTRUCTION

Section 211 of the MAG Uniform Standard Specifications shall apply, except as modified herein.

211.1 DESCRIPTION:

Add the following:

For the purpose of this provision, the term “Common Fill” shall be used for the filling of miscellaneous holes, pits, erosional features and depressions and for fill material placed within the site above existing grade to achieve the design elevations.

The term “Structural Fill” shall be used to describe all placing and compacting of fill material for the construction of structures and all other areas not defined as “Common Fill”.

The work in this section consists of all processing, excavation, blending, screening, placing, and compacting of approved fill materials to the lines and grades shown on the Plans, and in particular, the placing and compacting of material for the construction of the new embankments, berm, and appurtenant access roads that are created or augmented by fill and the filling of miscellaneous holes, pits, erosional features and depressions.

211.2 PLACING:

Add the following:

Fill construction shall not be started until clearing and grubbing and proof-rolling is done for any area receiving fill, in accordance with the requirements of MAG Standard Specifications Section 201 and these Special Provisions.

211.2.1 Structural Fill:

Structural fill material shall consist of project excavation areas delineated on the Plans and these Special Provisions. All fill placement shall be free of vegetation, debris, organic contaminants. All fill placement shall be free of rocks and other solid material in excess of three (1) inch in size. The structural fill shall have a Plasticity Index (PI) ranging from at least eight (8) to no greater than twenty (20) when tested in accordance with ASTM D 4318.

END OF SECTION

SECTION 220 – RIPRAP CONSTRUCTION

Section 220 of the MAG Uniform Standard Specifications shall apply, except as modified herein.

220.2 MATERIALS:

Add the following:

The term “geotextile” fabric shall be synonymous with geosynthetic fabric as described in the MAG Specs.

Erosion control geosynthetic fabric for all new loose riprap construction shall conform to the requirements of Class A fabric per Table 796-3 in Section 796 of the MAG Uniform Standard Specifications. Geosynthetic fabric placement shall be incidental and appurtenant to the riprap construction and no separate payment will be made for geosynthetic fabric placed with plain riprap.

New riprap shall conform to the requirements of Section 703 and shall require the approval of the Engineer prior to use in Project.

220.3 PREPARATION OF GROUND SURFACES:

Add the following:

For all new riprap construction, the subgrade shall be excavated to allow for the installation of geosynthetic filter fabric and riprap. The riprap areas shall be excavated to the depth shown on the plans or called for in the Special Provisions in order to place geosynthetic material and riprap. The subgrade shall be excavated to accommodate the thickness of the riprap pad so that the finished grade of the riprap matches the grades on the plans.

220.4 PLACEMENT OF EROSION CONTROL GEOSYNTHETIC FABRIC:

Add the following:

The geosynthetic shall be placed in the manner and at the locations identified in the Plans or as directed by the Engineer. At the time of installation, the geosynthetic shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation, storage, or placement.

To maintain the integrity of geosynthetic filter fabric below the rock, the Contractor shall ensure that no damage to the geosynthetic material occurs during placement of the riprap. On sloping surfaces, riprap placement should always begin at the base of the slope and move upward, and from the center of the geosynthetic strip to its side edges. Stones should not be allowed to roll. The maximum drop height for stones shall be two (2) feet. Avoid machine grading or any method of shifting riprap after it is placed unless the fabric is covered sufficiently to avoid damage.

Place the riprap to the limits, elevation, and thickness shown on the Plans. Elevation measurements shall be staked prior to placement of riprap and to be inspected and verified in the field by the Engineer.

220.5 RIPRAP PLACEMENT:

Add the following:

220.5.1 Dumped Riprap:

Dumped riprap shall be installed at the locations and in accordance with the details on the plans. Stone shall be sound and durable, free from seams and coatings, and of such characteristic that it will not degrade in water. Waste concrete may not be used. All stones shall be angular, with rough surface texture. Stone size shall be in accordance with the gradations shown on the plans. Thickness of any dumped riprap layer is to be at least twice the D50 as shown on the plans. Stone color shall match color of existing stone or as approved by the Project Engineer.

Contractor is to provide a sample of at least one cubic yard of rip rap on the site for approval by the Project Engineer prior to placing rip rap. The sample shall be representative of the gradation, stone soundness, angularity, etc, of the rock to be supplied for the job. Once the sample is approved by the Project Engineer, all subsequent rock supplied shall be from the same source. Additional samples will be required if the source of the rock changes during construction.

220.6 GROUTED RIPRAP:

Add the following:

Grouted riprap shall be installed at the locations and in accordance with the details on the plans. Stone shall be sound and durable, free from seams and coatings, and of such characteristic that it will not degrade in water.

Contractor is to provide a sample of at least one cubic yard of rip rap on the site for approval by the Project Engineer prior to placing rip rap. The sample shall be representative of the gradation, stone soundness, angularity, etc, of the rock to be supplied for the job. Once the sample is approved, all subsequent rock supplied shall be from the same source. Additional samples will be required if the source of the rock changes during construction.

220.8 PAYMENT:

Add the following:

Riprap shall be paid for at the bid price per cubic yard and shall include, but not be limited to, surface preparation, grout, filter fabric, and other materials, labor, equipment, maintenance, and any incidentals thereto, in order to complete the work in accordance with the Standard Specifications..

END OF SECTION

SECTION 430 – RE-VEGETATION AND SEEDING

Remove Section 430-Landscaping in its entirety and replace with the following:

The work under this item shall consist of furnishing all materials, preparing the soil, applying seed, and establishing the seeded areas. Areas to be seeded are those disturbed or unvegetated areas listed herein, shown on the plans, called for in the contractor's erosion control plan, or designated by the Project Engineer. All disturbed areas with the exception of channel bottoms shall be re-vegetated according to this specification.

Seeding shall be accomplished in two stages. The first stage shall consist of tillage; furnishing and applying compost, chemical fertilizer, and sulfur; furnishing and planting the contract specified seed mix; and furnishing, applying and affixing final mulch cover. The second stage, beginning after the first stage has been accepted by the Project Engineer, shall be a 60 calendar day period during which time the contractor shall be responsible for maintaining and stabilizing the seeded and mulched areas, and restoring damaged or eroded areas.

Seeding used as part of a SWPPP shall be completed before the end of the contract time, or sooner as required in the SWPPP. The 60 calendar day maintenance period is not included in the 125 calendar day construction time.

Appropriate documentation, as specified below, shall be submitted to the Project Engineer a minimum of 30 calendar days before the start of a scheduled seeding activity. No materials shall be delivered to the site until the documentation has been approved by the Project Engineer.

Unless otherwise specified, Certificates of Compliance shall be provided for all materials.

The contractor shall also provide test from accredited laboratories for all materials, as specified herein. Should the contractor perform its own testing, such test results shall also be provided to the Project Engineer.

430.1 GENERAL REQUIREMENTS:

The species, variety, and strain of seed (designated elsewhere herein as contract-specified seed) shall be as shown on the plans or as specified herein. The contract specified seed shall be obtained from seed suppliers through harvesting of wildland collections, or field grown seeds grown prior to or during the contract period.

Within 30 calendar days after the award of contract, the contractor shall submit the name of the seeding subcontractor to be used, along with written confirmation from seed suppliers and collectors, on their letterhead, that the source(s) for the contract specified seed has been secured. If any of the contract-specified seed is expected to be unavailable prior to the time specified for seeding the contractor shall notify the Project Engineer at this same time.

The seed shall be delivered to the project site unmixed in standard, sealed, undamaged containers for each seed species. Each container shall be labeled in accordance with the appropriate provisions of the Arizona Revised Statutes and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Labels shall indicate the variety or strain of seed, the percentage of germination, purity and weed content, the date of analysis which shall not be more than nine months prior to the delivery date, and testing information. A Certificate of Analysis from an accredited seed-testing laboratory shall accompany each container of seed.

Unless otherwise approved by the Project Engineer, weed content of the contract-specified seed mix shall not exceed 0.5 percent.

The contractor shall provide all seed tag labels to the Project Engineer. No payment will be made for seed unless tag labels from all seed to be used on the project have been submitted as specified.

The contractor shall store seed under dry conditions, at temperatures of between 35 °F and 120 °F, and out of direct sunlight. Prior to using the seed, the contractor shall provide a certification letter to the Project Engineer that the seed was stored as specified herein.

Legume seed shall be inoculated with appropriate bacteria cultures approved by the Project Engineer, in accordance with the culture manufacturer’s instructions.

Tetrazolium staining shall be acceptable to test for germination and hard seed. Cut or fill testing will not be allowed. As directed by the Project Engineer, seeds with an expiration date past the acceptable test date or not meeting the specified conditions for storage shall be retested by the contractor. The Project Engineer may perform random sampling of seeds throughout the project. Mixing of the specified seed at the project site shall be under the supervision of the Project Engineer.

Use the following SEED LIST & MIX:

SEED LIST & MIX		
COMMON NAME	BOTANICAL NAME	PERCENTAGE
Sand Dropseed	Sporobo/us cryptandrus	30
Green Sprangletop	Leptochloa Dubia	20
3-Awn	Aristida Purpurea	15
AZ Cottontop	Digitaria Californica	10
Plains Bristlegrass	Setaria Macrostachya	10
Desert Marigold	BaHeya Multiradiata	5
Globe Mallow	Sphaeraiceae Ambigua	5
4-Wing Saltbush	Atriplex canescens	5
Total		100
Application Rate		21 lbs/acre

430.1.1 Seed Substitution:

No substitution of the contract-specified seed will be allowed unless evidence is submitted documenting that the contractor has made a diligent effort to obtain the contract-specified seed from either seed suppliers or collectors, and that the contract-specified seed will not become available prior to the time specified for seeding in the contractor’s approved construction schedule.

Should a substitution of the contract-specified seed be requested and the contractor’s documentation is approved by the Project Engineer, Cochise County’s Engineering & Natural Resources Department will specify an alternate seed within five working days of the Project Engineer’s approval of the contractor’s documentation. The alternate seed will only be allowed when there is an insufficient quantity of the contract-specified seed, as determined in the previous two paragraphs, for the areas to be seeded as called

for herein or as required for erosion control. The contractor shall obtain and apply the alternate seed, as required, to all such remaining areas. Unless otherwise approved by the Project Engineer, the approved alternate seed will only be allowed until such time that contract specified seed meeting the availability and price requirements specified herein can be provided.

No payment will be made for areas seeded with unapproved seed.

430.1.2 Tacking Agent:

Tacking agent shall be a naturally occurring organic compound, and shall be non-toxic. The tacking agent shall be a product typically used for binding soil and mulch in seeding or erosion control operations. Approved types shall consist of mucilage or gum by dry weight as active ingredient obtained from guar or plantago. The tacking agent shall be labeled indicating the type and mucilage purity.

The contractor shall have the tacking agent swell volume tested by an approved testing laboratory using the USP method. The standard swell volume shall be considered as 30 milliliters per gram. Material shall have a swell volume of at least 24 milliliters per gram. Certified laboratory test results for homogenous consistency shall be furnished to the Project Engineer for each shipment of tacking agent to be used on project areas. Tacking agent rates shall be adjusted to compensate for swell volume variation. Material tested with lesser swell volume shall have the tacking agent rate increased by the same percentage of decrease in swell volume from the standard 30 milliliters per gram. Material tested with greater volume may reduce tacking agent rates by the same percentage of increase in swell volume from the standard 30 milliliters per gram. Tacking agent shall be pure material without starches, bentonite, or other compounds that would alter the swell volume test results of mucilage, or the effectiveness of the tacking.

430.1.3 Straw Mulch:

General:

Straw mulch shall be from the current season's crop. A letter of certification from the supplier shall be required stating that the straw was baled less than 12 months from the delivery date.

All straw, including hydraulically applied straw, shall be free from noxious weeds in compliance with the standards and procedures of the North American Weed Management Association (NAWMA) or the Arizona Crop Improvement Association (ACIA). The contractor shall provide documentation, including a transit certificate, and appropriate labels and/or marking twine, from the ACIA or NAWMA that straw materials to be used for mulch are free of noxious weeds. The straw shall be accompanied by the certification, labels and/or marking twine at the time of delivery to the project site. Straw delivered to the project without such information will be rejected, and promptly removed from the project.

Rye straw and oat straw will not be acceptable.

Straw Mulch for Hydraulic Application:

Hydraulically applied straw mulch shall be wheat or rice straw processed to various particle sizes, mixed with water and tacking material, and applied as a non-clogging slurry using a hydroseeder. A minimum of 70 percent of the wheat or rice straw in the mix shall be not less than 1/2 inch \pm 1/4 inch in length. Straw particles may be longer provided that the particles can be used with the selected hydroseeder without clogging. Hydraulically applied straw mulch, as furnished by the manufacturer, may contain up to 10 percent paper or cotton materials in dry weight, as well as 5 to 20 percent of wood fiber in dry weight. The

combined dry weight percentage of paper, cotton, and wood fiber materials together shall be not less than 15 percent nor more than 30 percent of the hydraulically applied straw mulch.

Hydraulically applied straw mulch material from the following sources shall be acceptable:

<p>Hydra Matrick North American Green 5401 St Wendel-Cynthia Road Poseyville, IN 47633 Phone: 1-800-772-4297</p>	<p>Hydro Straw Hydrostraw LLC 3676 W 9000 N Road Manteno, IL 60950 Phone: 1-800-545-1755</p>
<p>Shot Straw Rio Ranches LLC PO Box 156 Palo Verde, AZ 85343 Phone: 602-680-8320</p>	<p>DuraBlend 361 PrimeOne Products LLC PO Box 30816 Spokane, WA 99223 Phone: 509-981-8555</p>

Chemical Fertilizer and Sulfur:

Fertilizer shall be composed of a mixture of one part sulfur-coated urea 25-4-8, one part monammonium phosphate 11 52 0, and one part methylene urea 38-0-0. The sulfur-coated urea, a blended fertilizer 25-4-8, shall have approximately 80 percent of the nitrogen defined as slow release, and contain 5 percent Iron, 10 percent sulfur and trace amounts of zinc and manganese. The result shall be a 24-18-2 chemical blended fertilizer, as specified herein.

Chemical fertilizer and sulfur shall be applied at the rate of 200 pounds each per acre. Compost shall be applied at the rate of 15 cubic yards per acre.

Water:

Water shall be free of oil, acid, salts or other substances which are harmful to plants. The source shall be as approved by the Project Engineer prior to use.

Compost:

Compost shall consist of composted organic vegetative materials. Prior to being furnished on the project, compost mulch samples shall be tested for the specified microbiological and nutrient conditions, including maturity and stability, by a testing laboratory approved for testing of organic materials. Such testing shall have been performed within six months of time the compost is to be furnished to the project. Written test results shall be submitted to the Project Engineer for approval.

Compost material shall be dark brown in color with the parent material composted and no longer visible. The structure shall be a mixture of fine and medium size particles and humus crumbs. The maximum particle size shall be within the capacity of the contractor’s equipment for application to the constructed slopes. The odor shall be that of rich humus with no ammonia or anaerobic odors.

Compost shall also meet the requirements of the following Table:

Cation Exchange Capacity (CEC)	Greater than 50 meq/100 g
Carbon:Nitrogen Ratio	Less than 20:1
pH (of extract)	6.0 – 8.5
Organic Matter Content	Greater than 25%
Total Nitrogen (not added)	Greater than 1%
Humic Acid	Greater than 5%
Maturity Index	Greater than 50% on Maturity Index at a 10:1 ratio
Stability	Less than 100 mg O ₂ /Kg compost dry solids – hour

430.2 CONSTRUCTION REQUIREMENTS:

430.2.1 Seeding Operations:

At least two weeks prior to beginning seeding, the contractor shall complete and submit a batch mix and seed application form to the Project Engineer for approval. The batch mix form will be supplied by the Project Engineer.

The contractor shall notify the Project Engineer at least two days prior to commencing any phase of seeding operations for the remainder of the project.

The equipment and methods used to distribute seeding materials shall provide an even and uniform application of seed, mulch, and other materials at the specified rates.

Unless specified otherwise in the Special Provisions, seeding operations shall not be performed on undisturbed soil outside the clearing and grubbing limits of the project or on steep rock cuts.

The contractor shall coordinate the seeding operations with the grading operations to determine mobilization frequency as embankment and cut slopes are finished throughout the duration of the project. Seeding shall be done during suitable weather and soil conditions for tillage and placement of materials. Seeding operations shall not be performed when wind exceeds 10 miles per hour or, if in the opinion of the Project Engineer, conditions would prevent uniform application of materials or would carry seeding materials into areas not designated for seeding.

The contractor shall not expose an area greater than 750,000 square feet at any one location within the project limits until the seeding proposed for that portion of the project has been installed and accepted by the Project Engineer. Seeding shall be accomplished within 14 days after slopes and disturbed areas have been completed.

430.2.2 Tillage:

Where equipment can operate, the area to be seeded shall be prepared with a ripper bar, chisel plow, or with other devices to provide thorough soil cultivation to the depth specified below.

For areas too steep to be prepared for seeding after the slope has been completed, as determined by the Project Engineer, tillage shall be accomplished with appropriate equipment as the slope is being constructed. On slope areas, all tillage shall be directional along the contours of the areas involved. All

areas which are eroded shall be restored to the specified condition, grade, and slope as directed prior to seeding.

Cut slopes shall be prepared with ridges and deep tillage, or shall be mini-benched. On fill slopes, the operations shall be conducted in such a manner as to form minor ridges thereon to assist in retarding erosion and favor germination of the seed.

Cut slopes shall be tilled to a six inch minimum depth. All slopes steeper than 3:1, and areas which could potentially be affected by underground utilities, shall be tilled to a minimum 6 inches in depth, and left in a roughened condition as they are constructed.

Tillage shall be a minimum of two inches in depth for the first ten feet from the edge of pavement, including shoulder build-up areas.

Care shall be taken during the seeding operations to prevent damage to existing trees and shrubs in the seeding area.

Tillage may require passing the equipment over the area several times to provide thorough soil cultivation. Furrows from tillage shall be no more than 12 inches apart. No work shall be done when the moisture content of the soil is unfavorable to tillage.

All competitive vegetation shall be uprooted prior to seeding and the soil shall be left in a friable roughened condition free of clods or large stones over four inches in any dimension, and other foreign material that would interfere with the seeding operation. Exposed stones larger than four inches shall be removed and disposed of in an approved manner prior to grading and seeding.

Regardless of the method of seeding application, all areas prepared with tilling shall have chemical fertilizer and soil amendments (sulfur and compost) uniformly applied and incorporated into the soil prior to final tillage and seeding.

Chemical fertilizer and sulfur shall be applied at the rate of 200 pounds each per acre. Compost shall be applied at the rate of 15 cubic yards per acre.

Unless otherwise approved by the Project Engineer, bulk compost shall be applied, using broadcast methods, to all areas where equipment can be operated. For areas where bulk compost cannot be applied by broadcast methods, as determined by the Project Engineer, compost shall be applied hydraulically at the rate of 1,500 pounds per acre. Compost may be combined with seed in the same slurry. Sulfur and fertilizer shall be applied separately.

Slopes 3:1 and flatter shall have fertilizer, sulfur, and compost tilled into a minimum of the top four inches of the surface. Slopes steeper than 3:1 shall have fertilizer, sulfur, and compost uniformly broadcast for incorporation into the soil as directed by the Project Engineer. Fertilizer and sulfur shall not be applied hydraulically to any seeded areas.

For mini-benched slopes, fertilizer, compost, and sulfur shall be applied to at the specified rates with no tillage or incorporation.

430.3 SEEDING:

430.3.1 General:

Drill seeding with straw mulch shall be considered as the preferred method of seed application when practicable. Unless otherwise approved by the Project Engineer, drill seeding shall be used for all areas with slopes of 3:1 or less.

Hydroseeding shall be the alternative method for seed distribution for slopes in excess of 3:1, and where drill seeding is not practicable or suitable for soil conditions and seed types, as determined by the Project Engineer.

Seeds not suitable for drill seeding and hydroseeding methods shall be broadcast manually. Areas to be seeded manually shall be completed after the final soil tillage and prior to any drill or hydroseeding.

Straw mulch or hydraulically applied straw mulch shall be applied on all seeded areas within 24 hours of seed application. Seeding application shall be accomplished prior to application of straw mulch or hydraulically applied straw mulch. Combining the seed application process with the mulching process will not be acceptable.

Unless otherwise specified in the Special Provisions, Class II seeding areas shall not be watered after planting.

430.3.2 Drill Method:

After the tillage and incorporation of fertilizer, sulfur, and compost is completed and accepted by the Project Engineer, seed shall be planted with a drill seeder capable of accurately metering the specific seed mix. Use of a drill seeder shall not damage the prepared seedbed, and shall provide a soil cover over the planted seed.

Seed shall be planted approximately 1/4 inch deep, with a maximum depth of 1/2 inch. The distance between the furrows produced using the drill process shall not be more than eight inches. If the furrow openers on the drill exceed eight inches, the area shall be drilled twice. Seeding shall be done with grass seeding equipment with double disc openers, depth bands, packer wheels or drag chains, rate control attachments, seed boxes with agitators and separate boxes for small seed. Seed of different sizes shall be sowed from at least two separate boxes adjusted or set to provide the planting rate as specified.

430.3.3 Hydroseed Method:

Areas and seed types not suitable for drill-seeding, as determined by the Project Engineer, shall be hydroseeded. The contract specified seed shall be applied in a slurry containing 200 pounds of thermally-refined wood fiber and a minimum of 40 pounds tacking agent per acre. Seed shall not be in the slurry for more than 30 minutes. Hydroseeded areas shall also be mulched within 24 hours of application of the seed.

430.3.4 Manual Application:

Manually applied seeds shall be broadcast evenly to produce uniform distribution over the seeded areas.

430.3.5 Applying Straw Mulch:

General:

Within 24 hours after each area is planted, straw mulch shall be uniformly applied at the minimum rate of 2 1/2 tons per acre for areas to be crimped and tacked, and minimum two tons per acre for tacked-only areas. Except for shoulder build-up areas, and unless otherwise specified by the Project Engineer, straw mulch shall be applied to all seeded areas. Areas to receive hydraulically applied straw mulch, if directed by the Project Engineer, shall be mulched.

During seeding and mulching operations, care shall be exercised to prevent drift and displacement of materials. Mulch material which is placed upon trees and shrubs, roadways, structures, and upon any areas where mulching is not specified, or which is placed in excessive depths on mulching areas, shall be removed as directed. Mulch materials which are deposited in a matted condition shall be loosened and uniformly spread to the specified depth over the mulching areas. Any unevenness in materials shall be immediately corrected by the contractor. In addition, the contractor shall minimize production of dust or other airborne particulate matter during application of straw mulch, either by moistening the straw, modifying equipment with misters, or through other means approved by the Project Engineer.

Except as specified in the next paragraph, straw mulch applied to seeded areas shall be immediately affixed by crimping and tacking after application. No mulch shall be applied to seeding areas which cannot be crimped and/or tacked by the end of each day. Any drifting or displacement of mulch before crimping and/or tacking shall be corrected by the contractor at no additional cost to the Department.

Crimping shall not be required for areas that are steeper than 3:1. Crimping may also be waived, when specifically directed by the Project Engineer, for drill seeded or hydroseeded areas with rocky conditions or other areas deemed unsuitable by the Project Engineer for crimping. Straw mulch applied to such areas shall only be tacked.

Prior to the application of a tacking agent, protective covering shall be placed on all structures and objects where stains would be objectionable. All necessary precautions shall be taken to protect the traveling public and vehicles from damage due to drifting spray.

Anchorage by Crimping:

Crimping shall be required for all straw mulched areas. Straw mulch shall be anchored into the soil with a heavy disc. Discs shall be flat and serrated, with at least 1/4 inch thickness having dull edges, and spaced no more than nine inches apart. Straw mulch shall be anchored to a depth of at least two inches and shall not be covered with an excessive amount of soil. Anchoring operations shall be across the slopes where practical, with no more than two passes of the anchoring equipment. Immediately following the crimping operation, the crimped area shall be tacked as specified below.

Anchorage by Tacking:

Straw mulch shall be anchored by tacking, using a slurry consisting of a minimum of 150 pounds of tacking agent, 500 pounds of thermally refined wood fiber mulch, and 300 gallons of water per acre. The contractor may increase the quantities of components to ensure the stability of the straw mulch to provide erosion control during the 45 calendar-day maintenance period at no additional cost to the Department.

Hydraulically Applied Straw Mulch with Tacking Agent:

Areas seeded but not practical for straw mulch, as determined by the Project Engineer, shall have hydraulically applied straw mulch with tacking agent applied at the variable rates shown in the table below.

Slope (H:V)	Hydraulically Applied Straw Mulch (Pounds per acre)	Tacking agent (Pounds pure mucilage per acre)
Flat to 6:1	2,000	150
From greater than 6:1 to 3:1	2,500	150
Greater than 3:1	3,000	200
Erosive Soil Slopes or Highly Erosive Areas*	3,500	250

*As determined by the Project Engineer

The contractor shall submit a batch (tank) mix quantity schedule for mulch application to the Project Engineer for approval prior to mixing hydraulically applied straw mulch and tacking agent in a slurry. Batch mixing and coverage will be monitored throughout the seeding operations. The contractor shall coordinate the mixing and application operations with the Project Engineer in advance of all mixing. Fertilizer or seed shall not be mixed into any slurry for temporary erosion control mulch application.

The contractor shall submit a batch (tank) mix quantity schedule for mulch application to the Project Engineer for approval prior to mixing hydraulically applied straw mulch and tacking agent in a slurry. Batch mixing and coverage will be monitored throughout the seeding operations. The contractor shall coordinate the mixing and application operations with the Project Engineer in advance of all mixing. Fertilizer or seed shall not be mixed into any slurry for temporary erosion control mulch application.

Seeding Acceptance:

After application the Project Engineer will inspect seeded areas or sub-areas for conformance to the contract requirements. The contractor shall correct, to the satisfaction of the Project Engineer, any areas not conforming to the specifications. The 60-day maintenance period will begin upon acceptance of the area by the Project Engineer.

The contractor shall maintain and stabilize each area or sub-area, including shoulder build up areas, for a minimum period of 60 calendar days after application of the seeding and mulching materials, and acceptance by the Project Engineer. Any areas damaged from erosion, or that have less than 90 percent of applied mulch remaining, shall be re-seeded, re-mulched, and re-tacked at no additional cost to the Department.

Method of Measurement:

Seeding will be measured by the acre, to the nearest one acre of ground surface seeded. Measurements will be along the ground surface for the areas seeded and mulched, as approved by the Project Engineer.

Basis of Payment:

The accepted quantities for Seeding, measured as provided above, will be paid in two phases corresponding to the application stage and the 60 calendar-day maintenance stage.

Upon completion of the application stage and acceptance by the Project Engineer, the contractor will be paid 70 percent of the contract bid price per acre for the completed work. Such price will be considered full compensation for furnishing and applying the contract specified seed mix, fertilizers, soil amendments, tillage, mulch materials, and tacking agent, all required testing, and all equipment and labor required to complete the work as specified herein.

Upon completion of the 60 calendar-day maintenance stage, and acceptance by the Project Engineer, the contractor will be paid 30 percent of the contract bid price per acre for the completed work. Such price will be considered full compensation for seeding maintenance, including all equipment, labor, and materials required to correct deficiencies in seeded, mulched areas, as specified herein.

No measurement or payment will be made for the mobilizations required to apply and stabilize the seeding for each area or sub-area, as specified herein, the cost being considered as included in the contract price for Seeding.

An adjustment to the contract will be made if a contractor-requested seed substitution is approved.

END OF SECTION

SECTION 507 – ROLLER COMPACTED CONCRETE CONSTRUCTION

Add the following to the MAG Uniform Standard Specifications:

507.1 GENERAL:

507.1.1 Description:

A. Scope: This section describes requirements for furnishing all plants, materials and equipment, and performing all labor for the manufacturing, transporting, placing, compacting, testing, and curing of roller-compacted concrete (RCC). RCC mix design shall be the responsibility of the Contractor.

B. Definition: Roller-compacted concrete is a combination of crushed rock and/or natural sand, gravel, and/or soil having a controlled gradation to which cementing materials such as cement or cement and pozzolan are added. The materials are blended with water to a damp consistency that can be hauled in vehicles or delivered with a conveyor, spread with earth-moving equipment in layers, and compacted with a vibratory roller to produce a zero-slump concrete. The minimum 28-day compressive strength of RCC shall be 3,000 psi.

507.1.2 References, Specifications, Codes, And Standards:

A. Applicable Publications:

1. "Roller-Compacted Concrete," Symposium Volume of the American Society of Civil Engineers, May 1985.
2. "Roller-Compacted Concrete II," Symposium Volume of the American Society of Civil Engineers, February 1988.
3. "Roller-Compacted Concrete III," Symposium Volume of the American Society of Civil Engineers, February 1992.

B. American Concrete Institute (ACI):

1. ACI 207.5, *Roller-Compacted Mass Concrete*
2. ACI 211.1, *Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete*
3. ACI 214, *Recommended Practice for Evaluation of Test Results of Concrete*
4. ACI 304, *Guide for Measuring, Mixing, Transporting, and Placing Concrete*
5. ACI 305, *Hot Weather Concreting*
6. ACI 306, *Cold Weather Concreting*
7. ACI 308, *Standard Practice for Curing Concrete*
8. ACI 309, *Guide for Consolidation of Concrete*
9. ACI 318, *Building Code Requirements for Structural Concrete.*

C. American Society for Testing and Materials:

1. ASTM C 31, *Practice for Making and Curing Concrete Test Specimens in the Field*
2. ASTM C 33, *Specification for Concrete Aggregates*
3. ASTM C 39, *Test Method for Compressive Strength of Cylindrical Concrete Specimens*
4. ASTM C 40, *Test Method for Organic Impurities in Fine Aggregates for Concrete*
5. ASTM C 42, *Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*
6. ASTM C 87, *Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar*
7. ASTM C 94, *Specification for Ready-Mixed Concrete*
8. ASTM C 127 *Test Method for Specific Gravity Absorption of Coarse Aggregate*
9. ASTM C 128 *Test Method for Specific Gravity Absorption of Fine Aggregate*

10. ASTM C 131, *Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine*
11. ASTM C 138, *Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete*
12. ASTM C 143, *Test Method for Slump of Hydraulic Cement Concrete*
13. ASTM C 150, *Standard Specification for Portland Cement*
14. ASTM C 156, *Test Method for Water Retention by Concrete Curing Materials*
15. ASTM C 172, *Practice for Sampling Freshly Mixed Concrete*
16. ASTM C 173, *Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method*
17. ASTM C 192, *Practice for Making and Curing Concrete Test Specimens in the Laboratory*
18. ASTM C 231, *Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method*
19. ASTM C 260, *Specification for Air-Entraining Admixtures for Concrete*
20. ASTM C 295, *Guide for Petrographic Examination of Aggregates for Concrete*
21. ASTM C 470, *Specification for Molds for Forming Concrete Test Cylinders Vertically*
22. ASTM C 494, *Specification for Chemical Admixtures for Concrete*
23. ASTM C 535, *Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine*
24. ASTM C 566, *Test Method for Evaporable Moisture Content of Aggregate by Drying*
25. ASTM C 595, *Standard Specification for Blended Hydraulic Cements*
26. ASTM C 618, *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete*
27. ASTM C 685 *Specification for Concrete Made by Volumetric Batching and Continuous Mixing*
28. ASTM C 1040 *Test Methods for Density of Unhardened and Hardened Concrete in Place by Nuclear Methods*
29. ASTM C 1170 *Test Methods for Determining Consistency and Density of Roller-Compacted Concrete Using a Vibrating Table*
30. ASTM C 1435, *Molding Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Hammer*
31. ASTM D 3042, *Test Method for Insoluble Residue in Carbonate Aggregates*
32. ASTM D 4318, *Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*

D. American Association of State Highway and Transportation Officials, AASHTO M182 burlap cloth made from jute or kenaf.

507.1.3 Delivery, Storage, And Handling:

A. Cement and Pozzolan:

1. Transportation of Bulk Cement and Pozzolan: Transport cement and/or pozzolan from the railhead, mill, or intermediate storage to the mixing plant in adequately designed weather-tight trucks, conveyors, or other means that completely and thoroughly protect the cement or pozzolan from exposure to moisture.
2. Temperature of Cement: Deliver cement to the jobsite at a temperature not exceeding 160 °F. The temperature of the air used to transport cement into storage containers or silos must be less than 180 °F. The temperature of the air will be determined by measuring the temperature on the outside of the transport pipe with a surface thermometer.
3. Storage: Immediately upon receipt at the concrete plant, store cement and pozzolan in a dry, weather-tight and properly ventilated structure. All storage facilities are subject to approval and must permit easy access for inspection and identification. Store sufficient cement and pozzolan to complete at least 5 hours of placement at the typical production rate being experienced. To prevent cement and pozzolan from becoming unduly aged after delivery, use any cement or pozzolan that has been stored at the site for 60 days or more before using cement and pozzolan of lesser age.

B. Aggregates: Aggregate requirements are covered in Subsections 507.2.1 and 507.3.4. The Contractor's responsibility includes providing and delivering aggregates to the site, monitoring delivered quantities, and stockpiling in a manner preventing segregation, intermixing, and contamination.

C. Admixtures: Deliver admixtures to site in original manufacturer's containers. Store and handle in accordance with manufacturer's printed instructions.

507.1.4 Submittals:

A. General Requirements: Submit all required information within 30 calendar days following Notice-to-Proceed with the contract work unless otherwise specified.

B. RCC Mixing Plant(s) and Equipment:

1. RCC Mixing Plant:

- a. Submit a schematic drawing and narrative description of the RCC mixing plant and its anticipated peak and sustainable production rates.
- b. Submit detailed procedures for calibrating plant and monitoring materials used during construction.
- c. Submit calibration report prior to initiating trial placement.

2. RCC Handling and Conveying: Submit description of anticipated equipment for transporting, placing, compacting, and handling roller-compacted concrete.

3. If equipment needs vary during the course of RCC production and placement, submit the above items for each planned phase of work.

4. Cementitious Materials Storage: Submit a report on total capacity of all on-site storage facilities including silos, pigs, etc.

5. Submit a plan for curing completed exposed RCC surfaces.

C. Materials:

1. Cement and Pozzolan: Submit source(s) of cement and pozzolan. Submit samples as specified in Subsection 507.2.2.

2. Aggregates: Submit source(s) of all aggregates. Submit samples as specified in Subsection 507.2.2.

D. Submit delivery schedule as specified in Subsection 507.3.4 D.

1. Delivery Schedule: Submit delivery and production (where applicable) schedule for all materials.

E. Bedding Mix Design: Submit mix design and test results for bedding mix showing that the selected mix meets the requirement of Subsection 507.1.1 F. Submit 28-day compressive strength test results no later than 60 days following Notice-to-Proceed.

F. Delivery Plan: Submit a plan for transporting the RCC aggregates from the aggregate plant(s) to the RCC plant site. Include a map showing the proposed haul route(s); traffic control measures; the number, type, and weights (fully loaded) of haul vehicles to be employed; and height and weight restrictions for all bridges located along the proposed route(s).

G. Delivery Tickets: Submit delivery tickets for each delivery of cement, pozzolan, and bedding mix. Include the source, date manufactured or produced, type or class, Contractor's name, project name, and a certification that the material meets the specification requirements. Include the following information on each delivery ticket for each load or batch of bedding mix:

1. Name and location of batch plant
2. Ticket number
3. Load and truck number
4. Date
5. Destination
6. Concrete class
7. Batch weights for all materials
8. Amount of concrete
9. Time mixer charged with concrete
10. Recording of revolution counter (transit-mixed concrete)
11. Space for initials of receiving party

H. Personnel: Provide an organization chart showing key individuals to be assigned to production and placement of roller-compacted concrete. For each individual on the organization chart, provide a resume showing applicable experience on similar projects, total years of experience, duration of each assignment, names of similar projects, client names, addresses, and phone numbers, and nature or responsibility on each assignment. At a minimum, include the Project Manager, Project Superintendent, RCC Production Supervisor(s), RCC Placing Supervisor(s), and Quality Control Manager or Engineer on the organization chart.

I. Quality Control Plan: Submit Quality Control Plan addressing all items discussed in Subsection 507.3.14.

J. Hot and Cold Weather Concreting: Submit proposed plan for placing RCC during hot and cold weather conditions. Include planned procedures for heating and/or cooling materials, use of admixtures, and protection of completed work.

507.1.5 Testing By Engineer During Construction:

A. General: The Engineer will perform testing prior to and during construction to determine RCC mix proportions and compliance with the specifications. The Contractor shall cooperate with the Engineer and provide access to all parts of the site and provide access and facilities for collection of all material samples as necessary during all phases of the project.

B. Anticipated Testing Program: Testing by the Engineer is anticipated to include, but is not necessarily limited to, the following items:

1. RCC Mix Testing: Mix testing of RCC to determine the appropriate mix proportions for the project. This testing will be performed using representative material samples provided by the Contractor as described in Subsection 507.2.2 D.
2. Trial Placement Testing: Verification testing and inspection to determine that the RCC mix is produced and placed as intended by the specifications.
3. Production Placement Testing: Testing and inspection to determine that the RCC mix is produced and placed as intended by the specifications.
4. Post-Production Testing: Testing of samples prepared during construction to determine that the in-place material meets the requirements of the specifications.

C. Contractor Responsibility: Testing performed by the Engineer does not relieve the Contractor of his responsibility for performing all of the tests and inspections required by Subsection 507.3.14, Quality Control and Testing.

507.2 PRODUCTS:

507.2.1 Materials:

A. General: Roller-compacted concrete will be composed of portland cement, pozzolan (if required), aggregates, retarding admixture (if required), and water.

B. Substitutions and Alternate Sources: Substitutions or alternate material sources will not be permitted without advance approval by the Engineer.

C. Cementing Materials:

1. General: Provide portland cement that conforms to the requirements of ASTM C 150 or ASTM C595, Type II. If used, provide pozzolan that conforms to ASTM C 618, Class F. Furnish cement and pozzolan in bulk quantities to the jobsite.

2. Acceptance Requirements and Tests: Consistently supply cement and pozzolan with similar chemical and physical properties. Routinely check the chemical and physical properties of the cementitious materials for conformance with the specifications. Provide copies of all test results representing material sent to the jobsite prior to unloading those materials at the jobsite. Cement (and pozzolan, if used) may be subjected to spot testing by the Contractor or Engineer for samples obtained at the mill, at transfer points, and at the project.

D. Aggregates:

1. General: Deliver and stockpile aggregate for production of RCC as described in Subsection 507.3.4.

2. Quantity: Provide necessary aggregate to allow for overbuild, stockpile bases, trial placement, testing, waste, and materials used for Contractor's convenience.

3. Production and Delivery Schedule: Unless otherwise approved, maintain sufficient quantities of aggregate on-site for a minimum of two weeks of RCC placement at the maximum anticipated production rate.

4. Gradations: Meet the gradation requirements shown in Table 507-1.

5. Plasticity Index: The PI of the aggregate should be less than 5.

TABLE 507-1

Sieve size	Percent finer by weight		
	Fine aggregate	Coarse aggregate	All-in-one aggregate
2 inch	100	100	100
1-1/2 inch	100	100	100
1 inch	100	95-100	97-100
3/4 inch	100	-	-
1/2 inch	100	25-60	63-80
3/8 inch	100	-	-
#4	85-100	0-10	40-55
#8	-	0-5	-
#16	45-65	-	-
#30	35-50	-	-
#40	-	-	15-
#100	10-25	-	-
#200	5-10	0-2	4-10

E. Water: Provide water that meets the standard requirements for ready-mixed concrete as established in ASTM C 94, *Standard Specification for Ready-Mixed Concrete*.

F. Bedding Mix: Use bedding mix between the foundation or abutment and RCC and wherever required between layers of RCC. Retard bedding mix so that its initial set time exceeds 3 hours at 95 °F. It may be retempered within this time period before it is spread on the foundation or lift surface. Spread bedding so that the maximum thickness over rock foundations does not exceed 2 inches. Spread bedding mix to a minimum thickness of 1 inch on rock foundations and 3/8 inch on RCC lift surfaces. Spread RCC over the bedding and begin compacting into it within 45 minutes of when the bedding mix was discharged. Use mix proportions developed by the Contractor, based on trial mix testing approved by the Engineer. Use materials of the same type and from the same source as those used for the trial-mix testing. Proportion the bedding mix within the following general guidelines:

- Slump (placed on RCC)5 to 9 inches
- Maximum aggregate size..... 3/8 inch
- Minus 200 material (aggregate).....2% maximum
- Water reducing admixture..... may be required
- Design strength (28 day)2,500 psi
- Retarder as required to achieve the required delayed set time

Admixtures may be introduced into the mix to maintain its workability. Proportion the mix to be very workable and to minimize segregation. Batch bedding mix either on-site or offsite and transport to the lift surface by crane and bucket, transit truck mixer, pump, or other methods approved by the Engineer. Do not use conveyor delivery unless it can be demonstrated that the mix can be transported on the conveyor without any segregation. Pozzolan may be substituted for cement, up to a maximum of 30% by volume, provided that all specification requirements are met.

G. Chemical Admixtures: Provide water reducing agent and retarding admixture that conforms to ASTM C 494, type D, and water reducing admixture that conforms to type A requirements. Provide dose rates in accordance with the approved mix design and mix as recommended by the manufacturer.

H. Joint Materials: Provide and install joint materials in accordance with Section 507.3.10.

507.2.2 Mix Design(s):

A. General: Roller-compacted concrete mix proportions will be determined by the Contractor and approved by the Engineer.

B. Mix Proportions: An example RCC mix design(s) are approximated in Table 507-2 based on preliminary evaluation of potential aggregate, cement, and pozzolan sources (weights are based on saturated surface-dry aggregate). The final mix design(s) will be determined from testing performed by the Engineer using representative materials provided by the Contractor.

TABLE 507-2
Example Weights in pounds per cubic yard

MATERIAL	QUANTITY
1-1.5 in. nominal maximum size coarse aggregate	1500 pounds*
3/4 in. nominal maximum size coarse aggregate	1500 pounds*
Fine aggregate	2000 pounds*
Cement	750 pounds
Pozzolan	400 pounds

*The above represents nominal weights. If the contractor elects to supply the aggregates as a composite, the aggregates for mix design studies shall be supplied unsegregated in the amount of 4,000 pounds.

C. Mix Adjustments: Adjust mix water content based on continuous routine monitoring to obtain optimum compaction during all weather conditions. Do not adjust cement, pozzolan, or aggregate contents without written approval or direction from the Engineer. Cement and pozzolan adjustments will only be permitted or directed after development of sufficient supporting test results indicating justification for the adjustment.

D. Material Samples: Submit representative production samples of cement, pozzolan, and admixtures to the Engineer's laboratory within 30 calendar days following Notice-to-Proceed. Submit samples that are representative of those proposed for the project and include manufacturer's test reports indicating compliance with applicable specification requirements and showing all chemical and physical properties. Identify all materials with labels and/or tags as appropriate. Provide minimum quantities of materials as shown in Table 507-3.

TABLE 507-3

Material	Quantity
Fine aggregate	[2 tons]
Coarse aggregate	[2 tons]
Cement (in barrels or sealed sacks)	[0.3 ton]
Pozzolan (in barrels or sealed sacks)	[0.2 ton]
Water	[As requested by engineer]
Admixtures	[1 gallon each]

507.2.3 Equipment:

A. General: Provide sufficient equipment as described by these Specifications and the Contract Drawings.

B. Equipment Substitutions: After equipment is demonstrated as suitable for production and placement, as indicated by Contractor submittals, calibration report(s), mixer uniformity test results, and the trial placement, no substitution of equipment will be permitted without prior written approval by the Engineer.

C. RCC Mixing Plant(s):

1. General: Select the RCC mixing "plant" to be used and determine its layout. The plant includes all necessary mixers, volumetric or weight controls, storage bins, feed systems, and discharge mechanisms. Provide the RCC mixing plant at the site, in place, in operating condition, and calibrated prior to the start of the trial placement. Do not initiate trial placement until written calibration and uniformity test reports have been submitted to, and approved by, the Engineer. Provide plant(s) capable of routinely and consistently producing well-mixed RCC and with demonstrated satisfactory performance with similar mixes. The minimum sustainable capacity of the plant(s) must be at least 200 tons per hour using the specified mixes.

2. Description: Provide twin shaft paddle-type continuous mix or batch-type "pugmill" plant(s). Do not charge mixers in excess of the capacity recommended by the manufacturer for RCC. Provide mixers capable of combining the materials into a uniform mixture and capable of discharging this mixture without segregation. Batch-type drum mixers may also be submitted for approval provided that they have proven satisfactory with similar mixes and can meet the required production rates. It must also be demonstrated that they have low maintenance, available spare parts, and the ability to meet variability requirements. Traditional drum-type mixers must demonstrate that the specific plant consistently meets uniformity requirements specified herein. The plant's transfer systems must be capable of charging and discharging the constituents and the mixed product without bridging or choking.

3. Mixing Time:

a. Batch-Type Drum Mixers: The minimum mix retention time should be 90 seconds. Prior to the test section, mixer uniformity tests, performed in accordance with Section 507.3.3C must be performed. Longer mixing times will be required if needed to meet the tolerances in Table 507-4.

b. Continuous Mixing Pugmills: The minimum mixing time for continuous mixing pugmills or batch-type pugmills is 15 seconds. If the plant proposed by the Contractor has successfully mixed RCC of similar proportions and the plant operator has experience both with RCC mixing and the proposed plant, no mixer uniformity tests are required unless the Engineer determines there are

problems with the consistency of the RCC mix. At the direction of the Engineer, perform mixer uniformity tests. If the plant fails to meet the tolerances shown in Table 507-4, increase the mixing time to achieve compliance with Table 507-4 or use a new plant. Regardless of the type of mixing plant used, if it fails a uniformity test, no production work can begin or resume until a satisfactory test is performed.

4. Uniformity Tests: Where the proposed mixing plant does not have a record of successfully mixing RCC similar to that required for the project, perform a set of three mixer uniformity tests. The tests required for each set of uniformity tests is shown in Table 507-4. Take all samples for testing from the placement area following spreading of the material. A mixing plan will be considered acceptable provided that tolerances for 6 out of the 7 tests listed in Table 507-4 are met.

a. Batch-Type Mixers: For batch-type mixers, perform each set of uniformity tests on separate batches of roller-compacted concrete taken near the beginning, middle, and end of a shift of placement.

b. Continuous Mixers: For continuous mixers, perform each set of uniformity tests on samples taken near the beginning, middle, and end of a shift of placement.

TABLE 507-4

Test	Allowable maximum difference (See note 1)	ASTM Standard
Water content of full mix (percent by weight)	15%	D 2216
Coarse aggregate content of concrete (plus No. 4, percent by weight)	15%	C 94 (Annex)
Unit weight of air-free mortar (lb/y ³)	2%	C 94
Air content of full mix	100%	C 231
Wet unit weight (density) of full mix	2%	C 1170
Compressive strength at 7 days	25%	C 39
Vebe time	15%	C 1170

(1) Maximum allowable difference = (maximum value minus minimum value, divided by average of three tests).

4. Aggregate Bins: For each size group of aggregate, provide separate feed bins or compartments with steep side slopes, large gate openings, and capable of handling aggregate in a damp condition without choking. Provide bins with sufficient capacity to continuously supply the mixer operating at full capacity. Unless the aggregates in the bins are readily visible to operating personnel, equip each aggregate bin with mechanical or electrical sensors to indicate when aggregate in any bin is below the level to permit accurate delivery to the mixer.

5. Cement and Pozzolan Silos: Provide individual silos for bulk portland cement and pozzolan (if used) with ample size and so constructed that the various materials will remain separate under all working conditions. Separate all compartments containing cement (and pozzolan) from each other by a free draining air space. Clearly mark cement and pozzolan silos with signs to indicate the material contained in each silo.

6. Water Dispenser: Provide a water dispenser that is capable of dispensing the mix water within the specified requirements. Provide piping, valves, and other components that are free from leakage for delivering water to the mixer(s). Water may be weighed or metered by an in-line volumetrically activated flow meter. The valve must be capable of gradual adjustment during the mixing process to compensate for varying moisture contents in the aggregates. Use valves that are automatically controlled and close if cement, pozzolan, or aggregate stops entering the mixer at the required rate. This control may be bypassed for cleaning operation.

7. Sampling Facilities: Provide suitable facilities and labor for obtaining representative samples of materials as they enter the mixer, are discharged from the mixer, are discharged from gob hoppers, and from the placement after spreading but before compacting. Furnish all necessary platforms and equipment for obtaining samples.

D. Conveyors: Design and/or provide conveyors and transfer components for low maintenance, continuous operation with clean return belt surfaces and without segregation or excessive loss of material. Fit all belts with covers or shields to prevent drying by the wind and sun, and over-wetting from rain.

E. Haul Vehicles: RCC may be hauled using trucks, large front-end loaders, or scrapers from the plant discharge or conveyor discharge to various locations on the placement area. Tracked haul vehicles will not be permitted. Use bottom-dump haul vehicles, end-dump trucks with special tailgates or drop control methods that demonstrate an ability to handle dumping without excessive segregation, and/or front-end loaders. The haul vehicles must be free of deleterious materials including, but not limited to, oil, grease, loose, deteriorated, or dry RCC, and soil. The maximum free fall drop height from hauling vehicles is 5 feet.

F. Temporary Storage Containers: For continuous mixing plants provide a gob hopper or holding device for RCC temporarily accumulated after mixing and while waiting to be loaded into a hauling vehicle for transport. The gob hopper is not required if a total conveyor system without haul vehicles is used.

G. Chutes and Drop Tubes: Unless specifically authorized in writing, chutes or uncontrolled drops exceeding 5 feet will not be permitted.

H. Spreading Equipment: Provide equipment for spreading compatible with the capacity of the plant, delivery systems, and size of the work area. Equipment must be capable of placing the RCC in uniform lifts and without segregation.

I. Compaction Equipment:

1. Primary Rollers: Provide single or double drum, self-propelled vibratory rollers that transmit a dynamic impact to the surface through a smooth steel drum by means of revolving weights, eccentric shafts, or other equivalent methods. Use compactors with gross weights of not less than 21,000 lb, minimum dynamic force of at least 475 lb per inch of drum width at the operating frequency used during construction, vibrating frequency of at least 1500 cpm (cycles per minute), drum diameter between 4 and 6 feet, drum width of 5 to 8, and engine horsepower of at least 125. Within the range of operational capability of the equipment, variations to the frequency and speed of operation that result in maximum density at the fastest production rate will be allowed. Any other compaction equipment proposed must demonstrate that it is capable of compacting the RCC full depth to the specified density prior to RCC production. Provide at least one fully operable, self-propelled vibratory roller on the placement area at all times during production placement. Provide standby replacement equipment available for functional operation on the placement within 30 minutes.

2. Small Vibratory Rollers: Use small vibratory rollers that can operate within a few inches of a vertical face to compact the RCC adjacent to formwork, precast panels, conventional concrete structures, abutment slopes, and at other areas where the large vibratory rollers specified above cannot maneuver. Provide rollers with a dynamic force of at least 150 lb/in. of drum width for each drum of a double drum unit and at least 300 lb/in. of drum width for a single drum unit. Provide at least one fully operable, small roller at the site during RCC placement. Provide standby replacement equipment available for functional operation on the placement within 30 minutes.

3. Tampers, Plates, and Rammers: Provide tampers, plates, and rammers that develop a force per blow of at least 3500 lb per square foot. Maintain at least two tampers, plates, or rammers in good operating condition at the site during RCC placement.

507.3 CONSTRUCTION:

507.3.1 Schedule and Weather Restrictions:

A. Schedule: It is the intent of this specification to construct the RCC in a continuous operation to the extent practical.

B. Cold Weather Concreting: When ambient temperatures fall below 35 °F, institute cold weather concreting procedures as described in Subsection 507.3.12.

C. Hot Weather Concreting: Suspend RCC placement when the temperature of the RCC measured at the point of placement exceeds the limits specified in Subsection 507.3.8, or if a combination of high ambient temperatures and wind dries the uncompacted RCC, preventing adequate compaction.

D. Placing During Precipitation: Do not place RCC during heavy rains (more than 0.2 inch per hour or 0.03 inch in 6 minutes as defined by the U.S. Weather Bureau Glossary of Meteorology). Suspend production when free surface water begins to accumulate on the compacted RCC, when excessive pumping, tracking, or other unacceptable damage begins to develop, or when, in the opinion of the Engineer, rain is adversely affecting any aspect of quality. Remove any uncompacted RCC exposed to precipitation that, in the opinion of the Engineer, makes it unsuitable.

507.3.2 Foundation Preparation:

A. General: Prior to placing roller-compacted concrete on the foundation and against abutments, clean, fill with dental concrete (if necessary), shape (if necessary), and prepare exposed rock surfaces. Do not cover any foundation, embankment slope, or abutment area with any concrete or bedding mix until the area has been approved by the Engineer. Place bedding mix as described in Section 507.2.1F between the foundation or hardened conventional concrete and RCC mixes, except where shown otherwise. No RCC is to be placed in water or on soft foundation material.

B. Dewatering:

1. Groundwater Control: During the period of RCC preparation and placement, maintain foundations in a dewatered condition. For earth foundation surfaces, install dewatering systems that maintain ground water levels a minimum of 3 feet below the final foundation grade. For rock foundation surfaces, install dewatering systems that prevent ponding and water flowing over rock surfaces.

2. Surface Water Control: Prior to preparing the area for RCC placement, install facilities to divert surface water from the work area. Maintain facilities until all RCC placement and curing are complete.

C. Shaping and Filling Rock Surfaces: Fill depressions as directed by the Engineer with conventional dental concrete or roller-compacted concrete. Dental concrete placement areas will be decided by the Engineer depending on area access for equipment and thickness of lifts. Dental concrete may require rough face forming, as shown on the drawings. Continuously moist cure dental concrete for 7 days or until covered with additional RCC.

D. Preparation of Earth Slopes and Foundations: Prior to placement of RCC on or against any earth foundation or slope, remove all organics, soft or loose material. Loosen the remaining fill surface by scarifying, plowing, disking, or harrowing to a depth of 4 to 6 inches. Fill all depressions with soil of the same type as the surrounding soil. Adjust the moisture content of the surface as specified for the soil class and compact the foundation or slope to a minimum of 95% Standard Proctor. If allowed to dry, moisten earth slopes and foundations just prior to placing RCC.

E. Final Cleanup: Prior to placing any concrete or bedding mix, clean the surface to remove loose, unkeyed, and deteriorated rock; all mud, silt accumulations, vegetation, grease and spilled oils; frozen materials, standing water, accumulations of gravels, sands and loose rock fragments; laitance that may have accumulated on concrete surfaces; and any other detrimental material. It is expected that most of this can be accomplished with air blowing, high-volume water washing, and/or air/water jetting using equipment normally designed for this purpose and used in large scale foundation cleanups. High performance vacuum systems have also been effective for low areas or pockets in the foundation where water, soil and rock accumulates. A clean sound surface is required. Maintain surfaces upon which RCC or any bedding mix is placed in a damp condition and at a surface temperature in excess of 35 °F. Provide adequate equipment for air, air/water, and/or pressure water washing of the foundation.

507.3.3 Plant Calibration and Testing:

A. Initial Plant Calibration: Certify scales and calibrate plant in accordance with plant manufacturer's written instructions. Prepare and submit certifications and/or calibration report in accordance with requirements of Subsection 507.1.04.

B. Mixer Uniformity Testing: Perform mixer uniformity testing prior to trial placement to confirm that the mixer and handling and placing procedures meet the specification requirements contained in Table 507-4 and to determine the appropriate mixing time. Placement of RCC in the permanent work will not be permitted until the results of mixer uniformity testing are submitted to and approved by the Engineer.

C. Recalibration Interval: Perform recalibration of the plant following each 30 shifts or 5,000 cubic yards of placement or when quality control testing indicates a potential problem.

507.3.4 Aggregate Production, Delivery, And Handling:

A. General: The requirements of Subsection 507.3.4 B through C also applies when RCC is produced off-site and hauled to the project site.

B. Aggregate Production: Operate the aggregate production plant in an efficient manner to achieve and maintain an adequate level of productivity. Ensure that the final aggregate product is consistent and free from contamination by organic material, overburden, or other foreign materials.

C. Environmental Controls:

1. Stormwater Control: Implement work to conform to Best Management Practices for control of site runoff and stormwater pollution for the work area that encompasses the aggregate production plant, stockpiles, and related construction site areas.
2. Pollutant Control: Maintain aggregate plant areas in a clean orderly condition, free from spilled fuel, lubricant, coolant, or other potential pollutants. Maintain material handling areas to reduce potential for pollutants to enter stormwater runoff. Institute special precautions to prevent and to clean up spills of any material that might contaminate stormwater runoff.

D. Delivery:

1. Compliance with Regulations: The Contractor's responsibility includes ascertaining and compliance with all state laws and regulations regarding haul vehicle weight limits and other restrictions as they relate to haul vehicles on public roads. Where the point of ingress or egress is connected to a paved public road, provide a stabilized construction entrance adjacent to the paved area to minimize the amount of mud transported onto the paved area. Maintain the entrance pad and top dress with aggregate as required.
2. Delivery Route: Deliver aggregates using route(s) identified in the approved delivery plan.
3. Maintenance of Roads: Promptly remove, to the satisfaction of the Engineer and the haul route's jurisdictional authorities, any soil, aggregate, or other debris deposited on roads or adjacent areas as a result of the Contractor's activities associated with the work to be performed under this contract. If the Contractor fails to clean a road surface and adjacent areas in a timely manner, or fails to clean the road surface and adjacent areas to the satisfaction of the owner of the road, the owner of the road or the owner has the right to perform the corrective work and charge the Contractor for the cost incurred. If the Contractor fails to pay the charges, said charges will be deducted by the owner from the contract bid price. Perform a pre-haul survey that documents the condition of the haul route prior to initiation of hauling. Notify the Engineer as soon as any damage or deterioration to the road(s) occur that is likely to require remedial work.
4. Delivery Schedule: Within 14 days after Award of Contract, prepare and submit to the Engineer for approval a production and delivery schedule for the RCC aggregates. Limit delivery times to between 6:00 a.m. to 6:00 p.m., Monday through Saturday. Unless otherwise permitted by the owner, no Sunday delivery will be permitted. Requests for delivering RCC aggregates on Sunday must be submitted to the owner for approval.

E. Stockpiling Procedures: Stockpile aggregate at the project site within the boundaries designated on the plans. Establish precise limits of the piles as necessary to accomplish the work. Use separators, if necessary, such as timbers or boards between adjacent stockpiles to prevent contamination and intermixing between the stockpiles. Prepare the lane and the base of the aggregate stockpile by removing all organic material, flattening the area, filling any major depressions, and sloping the surface of the stockpile bases and the lane area to drain. Provide a base of free draining gravel or crushed rock, or allow for a sacrificial layer of material within the stockpile area. If used, the base material may have a maximum size up to 4 inches, not more than 10% passing the 3/4-inch sieve, and not more than 2% passing the No. 50 sieve. Construct stockpiles by an approved method that reliably and consistently stores the aggregates and later allows their withdrawal from the stockpiles without contamination or segregation. Provide a system that permits intermixing or blending of aggregates as they are delivered and spread in the stockpiles.

F. Moisture Conditioning: If aggregate evaporative cooling is utilized, or if products are sufficiently dry to require moisture conditioning, continuously mist aggregates during stockpiling to a saturated surface-dry

(SSD) condition. Use sprinklers or fog spray type and do not apply pressurized water directly into stockpile. Exercise caution during aggregate stockpile misting to prevent washing of fine material.

G. Stockpile Withdrawal: Withdraw aggregates from the stockpiles using conveyors, face loading with front-end loaders, or a combination of conveyors and face loading. Regardless of the method employed, withdraw materials that are representative of the entire stockpile, both in terms of gradation and moisture content. Blend any obviously segregated material with other material in a manner that will result in a gradation that meets the specifications. If the material cannot be suitably blended, separate it from the stockpile and use for other non-critical purposes, or waste the material.

507.3.5 Trial Placement:

A. Purpose: The Contractor should anticipate that at least one full day may be required to complete the goals of the trial placement. The Contractor is encouraged to expand the trial placement as necessary to demonstrate his ability to meet the specifications prior to proceeding with production placement.

B. Location: Construct the trial placement at a designated on-site location approved by the Engineer and in accordance with the details shown on the drawings.

C. Equipment and Placing Procedures: Demonstrate during the trial placement the intended construction techniques and materials to be used in construction of the structure. Tasks to be included are facing elements, lift-surface cleaning, compaction, density testing, cold joints, bedding-mix placement, and forming and/or shaping of steps and training walls. The supervisory and key craft personnel intended to perform the production placement must be involved in construction of the trial placement. Do not initiate the trial placement until the plant and all equipment required for delivery and placement of RCC are operational and fully calibrated. Perform mixer uniformity testing, as required by Section 507.2.3C, prior to initiating trial placement. Trial placement for the test section will not be permitted until the results on the uniformity testing, if required by Section 507.2.3C, are provided to the Engineer in writing and such test results demonstrate that the plant meets the specification requirements. Place a minimum of 100 cubic yards and three 12-inch-thick lifts in the trial placement. Place bedding mix, if required, on a minimum of two lifts as shown on the drawings. Anticipate and allow for numerous stops/restarts during the trial placement so that the Engineer may perform testing of the RCC. Demonstrate various spreading and compaction procedures including, but not limited to, various equipment types, and numbers of passes. Construct the trial placement just prior to production placement of RCC.

D. Testing and Quality Control: Prior to initiating the trial placement, perform testing of the aggregates in accordance with the requirements of Subsection 507.3.14 to demonstrate that specification requirements are met. Perform all other tests and quality control measures identified in Subsection 507.3.14 during the trial placement. In addition, the Engineer will perform his own tests and inspections and the Contractor should anticipate interruptions to his work to accommodate such tests and inspections. Allow 7 days from the completion of the trial section until production can begin so the Engineer can perform his evaluation of the test section.

E. Critique: The Engineer and Contractor will closely monitor activities during construction of the trial placement and provide an informal critique and review session for all involved, including supervision, inspection, Engineering, and craft personnel, prior to RCC placement in the structure.

507.3.6 Mixing:

A. Cement and Aggregate Feed: Feed cement and aggregates uniformly, continuously, and simultaneously, at the appropriate ratios for the mix design specified, into the mixer by belt or other acceptable method.

Feed controls may be by volume or weight. Aggregate feed may be accomplished by a single belt from each stockpile or from feed bins of the various size groups through openings at the bottom of the feed bins. Provide each opening in aggregate feeders with a gate that can be locked at the necessary opening size to provide the correct feed rate. Keep return side of all belts clean. Keep bins sufficiently full to allow a uniform flow of aggregate at an essentially constant rate. Particular attention may be needed to guarantee a continuous flow of the fine aggregate if it is very damp and is graded towards the fine side of the specified gradation band. Feed cement and pozzolan, if used continuously in a manner that can be controlled by adjusting the belt speed or feed rate. Provide special attention to the cement and pozzolan feed equipment so that it consistently and uniformly delivers materials even at low (100 lb/yd³ or less) dosage rates. Use feeds capable of gradual adjustment while in operation. Use continuously correcting automated gate openings and/or belt-feed rates by electronic feedback of weight sensor units on the belts if operation without them cannot provide the accuracy, consistency, and quality required by these specifications.

B. Operation: The intent is to operate continuous pugmills in a continuous manner at one set of feed rates with a minimum number of shutdowns and startups during RCC production placing. Calibrate and operate the plant so that all materials simultaneously begin feeding into the mixer at the correct rates when the mixer is started, and all materials simultaneously stop feeding into the mixer when it is stopped. No lag or lead time between materials will be allowed at the point where they enter the mixer. After material feeds are shut down, discharge all remaining material in the mixer. The initial RCC produced after a plant re-start may not conform to the specification requirements. If the plant can be stopped and re-started at the same mix proportions, no material has to be wasted. The need to waste material after a re-start will be evaluated for consistency and uniformity on a case-by-case basis by the Engineer. When the plant is shut down for over 30 minutes, waste the first cubic yard of material.

C. Accuracy: Proportion RCC discharged from the mixing plant within the tolerances shown in Table 507-5.

Table 507-5

Material	Accuracy limit (%)
Pozzolan (if used)	Plus or minus 2%
Cement	Plus or minus 2%
Water	Plus or minus 3%
Aggregate	Plus or minus 3%
Admixture	Plus or minus 3%

507.3.7 Conveying And Transporting:

A. General: Convey RCC from mixer to placement as rapidly as practicable, by methods that control segregation, contamination, and drying. If necessary, provide baffles at the end of conveyors and within hoppers to limit free falls, and at other locations that otherwise cause excessive segregation. Equipment will not be allowed to track mud or other contamination onto previously placed RCC. This may require using clean crushed rock on haul roads, washing tires of vehicles prior to driving onto the RCC, and other special measures. Any contamination on the RCC must be cleaned from the RCC prior to placing the next lift. The time from mixing to spreading the RCC must not exceed 30 minutes.

B. Temporary Storage Containers: Provide interim storage at gob hoppers (such as at a central dispatch point in the project vicinity) when vehicles are used for hauling, and when direct conveyor systems do not otherwise provide continuous unsegregated delivery to the final placement location. Use gob hoppers constructed with side slopes and gates that allow for the free flow of RCC without segregation or choking. Provide telephone or radio communication between gob hoppers, the mixing plant, and the placement site. If more than one RCC mix is used, completely empty gob hoppers before filling with a mix of a different design.

C. Conveyors and Haul Vehicles: RCC may be delivered to the placement area by either conveyors or haul vehicles or a combination of both, or by other methods if approved in advance by the Engineer.

1. Haul Vehicle Delivery: Haul vehicles will not be permitted to travel on and off any lift surface without precautions to prevent contamination of the RCC. Remove by hand or re-blend during spreading any segregation that results from using haul vehicles. Maintain hauling vehicles in good operating condition and prevent oil, grease, or other visible and obvious contamination to spill or drip onto the RCC. Operate haul vehicles in a manner that precludes tight turns, sudden stops, or other procedures that damage previously compacted RCC. If a surface is damaged by vehicle operation (tight turns, oil spills, etc.), clean the damaged surface or remove the damaged material.

2. Conveyor Delivery: Conveyor belt delivery may be required for all RCC delivered from the concrete plant to the point of final placement. The only RCC that will be considered for truck delivery to the placement area or active lift surface will be any trial placement or practice areas. Operate belts at speeds that meet production requirements and do not segregate materials.

507.3.8 Placing And Spreading:

A. General: The Contractor is cautioned to understand and apply applicable fall protection requirements to all work on the site. The Contractor is responsible for all health and safety requirements at the site.

B. Temperature Restrictions: Do not place RCC when ambient temperatures drops below 32 °F, unless the surface of the compacted RCC and the temperature of the RCC mix stays above 35 °F. In that case, placing of RCC during temporary periods will be permitted if the ambient temperature remains above 25 °F. If the ambient temperature drops below 32 °F or the surface of any RCC less than 7 days old drops to 35 °F, cover the surface with heavy tarps, blankets, straw, or other acceptable temporary protection until the ambient temperature rises above 35 °F. Remove RCC that is less than 7 days old and is exposed to temperatures less than 32 °F. Place all RCC at a material temperature of 90 °F or less. The temperature will be measured at the point where the RCC is delivered to the lift surface. Introduction of chilled water in the mix, cooling the coarse aggregate with chilled water, placement at night, spraying the coarse aggregate stockpile with chilled water, cooling material by injection with liquid nitrogen, or other approved measures will be required when this temperature restriction cannot be met by normal placement procedures.

C. Layout of the Placement Area: It is the intent of this specification to raise the RCC at essentially the same level across its entire area. As nearly as is practical, expose no more than two lift surfaces at one time. One additional layer may be exposed under special circumstances such as crossing conduits or other features. Maintain lift grade control by using grade stakes and/or laser-guided equipment, or other surveying methods. As placement of a lift progresses keep the exposed edges "live" by progressively placing out from them. Whenever a cold joint at any edge of any lift occurs, locate it at least 10 feet from the location of other cold joints that may have previously occurred in the same direction. Prepare the joint as required by Section 507.3.10 of these specifications for "cold joints" prior to resumption of RCC placement.

D. Depositing: Deposit RCC at the location at which it is to be spread. Where haul vehicle delivery is used, depositing will generally be accomplished with a dump-spread action while the vehicle is moving. When stationary end dumping is necessary, deposit the material on top of the fresh RCC layer being advanced, not on the previously compacted layer. Do not place material in piles higher than 5 feet. For belt delivery, limit pile heights and discharge from the belts in a manner that does not cause segregation. If trucks are used to deliver RCC, do not discharge material directly against any formwork. At isolated or confined placement locations, the Engineer may permit pushing the RCC up to 50 feet with spreading equipment, provided that segregation does not occur. Modify operations if excessive segregation is determined to be occurring by the Engineer.

E. Lift Thickness: Unless another lift thickness is satisfactorily demonstrated and approved during the trial placement construction, place RCC in 12-inch lifts as measured after compaction. Do not place RCC in compacted lifts less than 4 inches thick.

F. Spreading: Within 10 minutes of deposition, knock down and spread the RCC pile using a tracked dozer or other approved spreading equipment. Spread material so that it is placed in unsegregated layers that will result in a compacted lift with a thickness of approximately 12 inches and within the tolerances specified in Subsection 507.3.13. Where RCC is spread onto or into bedding mix, spread and compact the RCC mix within 90 minutes of the time the bedding mix was batched, prior to the time that it begins to set or dry from exposure, and within 45 minutes of when the bedding mix was first deposited. Do not operate tracked spreading equipment on compacted RCC unless tracks with flat rubber pads are used or rubber mats are placed between the compacted surface and the dozer tracks. Remove any loose material resulting from operation of equipment on compacted surfaces prior to placing the next lift. Have a front-end loader with operator available to assist with depositing and spreading of material in confined areas, at irregular

foundation conditions, and at other locations as needed. Accomplish spreading in a manner that does not cause segregation. If large aggregate rolls or segregates to the outside edge of a spread layer of RCC, re-blend it into the RCC or remove it. Maintain all equipment in good operating condition so that it does not leak or drip oil, grease, or other obvious visible contamination onto the RCC. Do not place concrete on a previous layer which is suspect and is being considered for testing, retesting, or rejection. RCC may be placed with an approved paver. Adjust the paver and regulate the speed to prevent segregation. Do not exceed a paver speed of 10 feet per minute unless it can be demonstrated to the satisfaction of the Engineer that higher speeds do not cause problems. Operate the paver with a constant supply of RCC in the hopper.

507.3.9 Compaction:

A. Determination of Optimum Compaction Density Value: The Engineer will determine the optimum compaction density value during the trial placement. The value will be established after evaluation of density results obtained with a nuclear density gauge and evaluation of the compaction characteristics for each mix design. Final evaluation of density results for the determination of the optimum compaction density value will be made only after all major field adjustments have been made and the mix design is considered to represent RCC that has suitable placement, spreading, and compaction characteristics, and provides the required strength and porosity values. Small field adjustments to the optimum compaction density value will be made throughout construction based upon the running average density value. Such changes may be made based on slight changes or long-term drift of density values resulting from field mix design adjustments.

B. Compaction: Within 45 minutes of water being introduced at the mixing plant, compact each 12-inch layer of RCC with a minimum of 4 passes of a self-propelled double drum or 8 passes of a self-propelled, single-drum vibratory compactor. (A round trip is 2 passes). Use the largest size equipment specified below that is capable of physical and practical operation in the area to be compacted. Use large width self-propelled vibratory rollers in open areas with a minimum of 4 vibratory passes on each lift. Use small walk-behind vibratory rollers and/or hand-guided power tampers for compaction at the abutments and in any areas that cannot be reached with the drum of a large vibratory roller. Do not operate rollers in the vibratory mode until they are moving. Maintain all compaction equipment in good operating condition at all times and do not allow it to drip or spill oil or other obvious visible contamination onto the RCC. Break down, trim, and compact the edge of all compacted layers against which adjacent RCC is not placed within 30 minutes so that the edge is thoroughly compacted and does not contain loose segregated aggregate. Spread and roll so that a flat surface results with minimum roller marks from the edge of the drum, and so that the drum does not bridge over any of the surface beneath the roller drum after the last pass. Operate rollers at speeds not exceeding 160 feet per minute.

C. Acceptance: The running average of 5 consecutive in-place density tests should not be less than 98% of the optimum compaction density value, with no individual test less than 96%. Determine the average wet density from the average of two readings taken with the gauge probe at a depth of 12 inches. If the two readings vary by more than 2%, repeat the density test. If it is demonstrated early in production that the two readings are consistently within 2%, the two readings can be discontinued. Also measure densities with the gauge probe at 4 inches and 8 inches; however, these readings will not be used to compute the average density.

D. Additional Compaction: If, after testing, the RCC does not meet the required density, it may be compacted with additional roller passes, provided that the time limit in Subsection 507.3.07A has not been exceeded.

E. Removal of Material: If the time limit specified in Subsection 507.3.7A has been exceeded and the RCC has not achieved the required density, remove the RCC and replace at no cost to the owner. Clean the

underlying surface and treat as a lift surface cold joint prior to replacing the removed RCC with new material.

F. Exposed Edge Compaction: Where lift edges are permanently exposed, compact or purposely overbuild edges to allow for trimming back to well-compacted RCC, meeting the design lines and grades. Edge compaction may be by excavator mounted vibratory compaction plates, or other means approved during the trial placement construction. Trimming may be performed manually or with mechanical equipment. The minimum density of unformed edges must be 95%.

507.3.10 Lift And Contraction Joints:

A. General: It is the intent of this specification to place the entire roller-compacted concrete mass with sufficient continuity so that it hardens and acts as one monolithic block (between contraction joints) without discontinuous joints or potential planes of separation. The length of time between placement of successive layers of RCC that can be tolerated is dependent upon temperature. Joint quality is also dependent upon cleanliness and surface moisture. When the limits between successive lifts of RCC layers exceed those specified herein, a cold joint will be considered to have occurred, and the procedures described for cold joints in Subsections 507.3.10C and D will be followed.

B. Routine Lift Surface Treatment: Keep joint surfaces in a clean, uncontaminated, and continuously moist condition until placement of the succeeding concrete. At a minimum, the Contractor should anticipate blowing every lift surface with compressed air if loose material and contamination are present. Employ a system to continuously maintain lift surfaces in a moist, but not wet, condition. The system may consist of, or be supplemented as necessary by, mists and light sprays from hand-held hoses to reach all areas of each lift. Heavy sprays from water trucks provide too much water and are not acceptable. Water trucks may be used if they can provide a fine spray or mist. Do not apply the mist or spray in a channeled or pressurized manner that erodes the fresh RCC surface or at a rate that causes ponding on the surface. Have at least one person on duty during RCC placement operations with the sole responsibility of operating the water system to keep the entire surface moist but not over-watered. He may be allowed to perform routine maintenance of nozzles and move hoses only if these activities do not prevent him from keeping the entire exposed surface in a continuously damp condition. During non-placement hours the RCC must be maintained in a moist condition either by on-site personnel or by covering the lift with tarps or plastic.

C. Lift Surface Cold Joints: A cold joint on a lift surface will be considered to have occurred when more than 4 hours have elapsed before placement of the successive lift. Determine degree-hours by accumulating the average temperature in degrees Fahrenheit at the lift surface during each one-hour increment after the surface has been compacted. Use a continuous clock-type temperature recording device, such as that manufactured by Forney Inc., Wampum, Pennsylvania, model number LA-0546-50, or equal, for determining and recording the time and temperatures. Prepare cold joints for the subsequent lift by removing all laitance, loose debris, and contaminants from the entire surface. Expose, but do not undercut the aggregate with the cleaning procedure. At this stage of maturity, use water jetting if air alone does not satisfactorily prepare the surface. After preparation, maintain the surface in a damp condition and place a layer of bedding mix with an average thickness as shown on the drawings over the lift surface.

D. Lift Edge Cold Joints: A cold joint on a lift edge will be considered to have occurred when more than 30 minutes has elapsed since placement of the material at the lift edge. Treat cold joints by trimming back the edge to compacted RCC a minimum of 9 inches on a 1H:1V slope prior to resuming RCC placement.

E. Contraction Joints (Vertical Joints): Construct contraction joints at the locations and alignment shown on the drawings. Any joint started at the foundation of the RCC must be continued to the full height of the

placement. The joint details shown on the drawings may be modified only with prior approval by the Engineer. The locations of several joints may be adjusted depending on foundation conditions encountered.

507.3.11 Reinforcing Steel and Anchor Bars:

A. General: Meet the requirements of N/A if used in the RCC, except modify placement as described herein.

B. Anchor Bars: Install in accordance with the requirements of N/A.

C. Reinforcing Steel: Locate reinforcing steel, including wall anchors, so that not less than a 2-inch nor more than a 5-inch clear distance exists between the bar and the surface of the RCC below it.

507.3.12 Curing And Protection:

A. Cold Weather Protection: Keep the surface of all RCC lift layers continuously damp and at a temperature above 35 °F until it is covered with the next layer of RCC, conventional concrete, earthfill, or asphalt, or until an age of 7 days has been reached. Comply with the temperature restrictions in Section 507.3.1. Measure the RCC temperature with a digital thermometer equipped with a surface probe. Protect from erosion by heavy rain and damage by water trucks all surfaces of RCC layers upon which subsequent layers will be placed. Clean any surface damaged by erosion that undercuts coarse aggregates, and cover with bedding mix prior to placing next RCC layer.

B. Moist Curing Requirements: Keep the surface of all RCC lift layers continuously damp until each is covered by the next layer or for a period of 14 days.

C. Use of Curing Compounds: Curing compounds will not be permitted on the RCC.

507.3.13 Facing Finish Treatment:

A. Forming: Construct the treatment(s) for the exposed face of the RCC as shown on the drawings and specified herein. Select a forming system and demonstrate at the RCC test section that it will provide RCC surfaces within the specified tolerances.

B. Unformed RCC:

1. Shaping and Cleanup of Exposed Face: During construction, routinely trim the unformed face with hand tools or other approved method to provide a relatively uniform and moderate-to-well compacted surface. Perform trimming in such a manner as to prevent removing material beyond the neat lines shown on the drawings and damage to surface and interior RCC. During or after RCC construction, remove any protrusions or obvious major discontinuities that may exist. Then clean the exposed RCC surface with a high-pressure water jet of not less than 3000 psi. Remove loose gravel or buildup at the toe of the RCC slope that is not advantageous from an aesthetic and/or drainage standpoint as directed by the Engineer. Acceptance of the project by the owner will not occur until all slopes and steps are clean of all accumulation of loose RCC. Material removed may not be reused within the RCC structure.

2. Tolerances: Construction tolerances for the exposed face are as follows:

a. During placement, limit gradual overbuild of the exposed downstream face to 1 foot. Underbuild will not be allowed.

b. After trimming and cleaning, limit gradual overbuild of the exposed RCC face to 0.5 foot. Underbuild will not be allowed.

c. Do not exceed 3 inches in 50 feet variation in any unformed exposed RCC surface after trimming and cleaning as measured in a straight line along the length and width of the face, nor 6 inches over the entire length and height of the embankment/weir. Clean any untrimmed surface that has been allowed to harden, and remove any objectionable protrusions.

d. Do not vary the upstream and downstream edges of the finished top of the RCC overtopping protection by more than 1 inch in 10 feet. Do not exceed the plan width by more than 6 inches. Place the top lift such that the final elevation of the top RCC layer is within 2 inches of that shown on the drawings and does not vary more than 1 inch in 10 feet. Underbuild will not be allowed.

507.3.14 Quality Control And Testing:

A. General:

1. Establish and maintain an effective, on-site, quality control program with the Engineer for the roller-compacted concrete. It will be the means of ensuring compliance with contract requirements and of maintaining records of control, including all tests and inspections, their findings, and the remedial actions taken when necessary. All testing and inspections described herein will be the responsibility of the Contractor.

2. Establish and execute the quality control program under the supervision of an RCC Quality Control Manager who will review and approve all activities concerning the production of materials, planning and scheduling of construction activities for placing RCC, and the running and evaluation of RCC tests. Work closely with the Engineer and keep the Engineer advised of planned construction procedures, the placing schedule, the testing schedule, and results obtained from tests. Designate an RCC Quality Control Manager for each shift. Several personnel may be required in the various areas of activity monitoring, testing, and reporting during the initial placement period. Make all information and test results available to the Engineer. Permit the Engineer full access to all construction and Contractor quality control activities.

3. At a minimum, include the following processes in the RCC Quality Control Program: aggregate stockpiling and handling, aggregate testing, mixing requirements and mix proportions at the RCC mixing plant(s), mix delivery, compaction, **joints**, material quality control, embedded items, erection of precast facings, and all other tests and inspections required by these specifications. Establish the program as described in the following subsections.

B. Aggregate Gradation:

1. Testing: At least once during each shift that RCC is placed and once during each shift that aggregates are delivered, test gradations for each aggregate size and for the combined gradation of all aggregates mixed at the designated proportions. A retest sample is required for any gradation test out of specifications. The location where samples are taken will be selected by the Engineer. Make provisions for accurate sampling of aggregates on feed belts to the RCC mixing plant.

2. Action Required: When a test result is outside of the specification limits, take a retest sample. If the retest sample is outside of the specification limits, suspend RCC production until the problem is corrected. The Contractor will be responsible for all costs incurred as a result of RCC placement suspension resulting from out-of specification materials.

C. Aggregate Moisture Determination:

1. Testing: At least once during each shift of RCC placement for each aggregate size used, test the moisture in accordance with ASTM C566. The location where the sample is selected may be determined by the Contractor provided that it is typical of materials entering the mixer. The frequency

of testing may be increased or decreased depending on moisture uniformity or variability as a project record is developed.

2. Action Required: When moisture content determinations indicate a change in water entering the mix with the aggregates, contact the placement foreman to see if a corresponding adjustment in water added at the mixer is necessary to obtain adequate compaction and meet consistency requirements at the placement site.

D. Material Finer Than the No. 200 Sieve:

1. Testing: During the first two weeks of aggregate stockpiling, perform tests every other day in accordance with ASTM C117 to determine the amount of material passing the No. 200 sieve for each aggregate size group. After it has been established that a problem does not exist, and if production remains constant, continued testing will be required once per week.

2. Action: When test results for material finer than the No. 200 sieve are outside of the specification limits, take action to correct the deficiency. Suspend RCC production until the problem is corrected. Materials produced "out of spec" may be blended with materials "in spec" so that the composite as used in RCC meets specification requirements.

E. Aggregate Quantities: Accurately monitor and record the quantity of each aggregate produced, delivered, stockpiled, and used during each shift. Maintain a cumulative record of the amount of each aggregate produced or delivered, used in the permanent work, and wasted. Base quantities on saturated surface-dry (SSD) moisture conditions. Also record the moisture content.

F. Cement and Pozzolan Quantities: Accurately monitor and record the quantity of each material delivered and used during each shift and the quantities of materials stored onsite. Maintain a cumulative record of the amount of each material delivered, used in the permanent work, and wasted.

G. RCC Mixing Plant Control: When the RCC mixing plant is operating, continuously control the amount of all constituent materials including cement, pozzolan, each size of aggregate, water and admixtures. Adjust the mixture proportions to compensate for free moisture in the aggregates as necessary. Prepare a daily report and submit to the Engineer before the start of the next shift indicating the type and source of cement used during that day, aggregate size groups used, required mix proportions per cubic yard for each mix design used, the amount of water as free moisture (above SSD) in each size of aggregate, and the aggregate weights per cubic yard of RCC produced during plant operation. Also include in the report the total amount of each material used per shift. Include in the daily report the proportions for each batch, for batch plants, and for each 10-minute interval for a continuous plant.

H. Scales for Weight Batching:

1. Tests and Checking: Check the accuracy of scales with test weights prior to the startup of concreting operations. Retest the scales at least every month of operation thereafter. In addition, retest whenever there are variations in properties of the RCC that could be the result of batching errors. When weight-batching procedures are used, frequently check the accuracy of each batching device during the startup of operations by noting and recording the required weight and the weight actually batched.

2. Action Required: When either the weighing accuracy or batching accuracy is found not to comply with specification requirements, do not operate the plant until necessary adjustments or repairs have been made.

I. Volumetric Feed Calibrations: Check the accuracy of volumetric feeds by collecting all material delivered to the mixer during a unit of time. Provide suitable methods and equipment for obtaining and handling

samples at the RCC mixing plant. Determine the weight of material delivered to the mixer during a time interval between 5 to 15 minutes as determined by the Engineer, and calculate the resulting proportions of materials per cubic yard. Determine the accuracy of volumetric feeds at least three times during checkout of the RCC mixing plant prior to production operations and RCC placement. Recalibrate plant at least every 30 shifts or 5,000 cubic yards thereafter and whenever there are variations in the properties or control of the RCC that could be the result of volumetric feed errors. Use samples of sufficient size to give accurate determinations. This may require sample weights in excess of 500 pounds per item checked.

J. Testing RCC Mixers:

1. General: Sample and test fresh concrete for compliance with the specifications at the placing location. Provide a method of readily obtaining representative RCC samples from the placement, the plant and gob hopper locations. Approximately 400 pounds of material will be required for each sample.
2. Mixer Performance: If a batch drum mixer is proposed, perform a complete mixer performance test on three different batches of RCC, or runs on each mix, prior to the test section. Additional tests may be made at any time to support a Contractor's request for reduction of mixing time. When mixer adjustments are necessary because of failure of a mixer to comply, retest the mixer after adjustment. Mixer performance test are required on a continuous pugmill plant if that plant has not produced RCC of similar proportions in the past. Tests may be required if the RCC shows signs of nonuniformity or inconsistency in test results.

K. Temperature:

1. Testing: Measure and record the RCC temperature on an hourly basis at the placement location. Perform additional tests when rapid set time or workability loss is reported by the placing foreman or Engineer, or during periods of hot or cold weather. Record the temperature of the air and the RCC during the period of cure and cold weather protection when those restrictions are applicable.
2. Action Required: When RCC temperature is outside the specification limits, suspend RCC placement until the problem is corrected. Include temperatures as standard data in the quality control reports.

L. Moisture Content:

1. Tests and Checking: Determine the moisture content of the RCC mix each time a density reading is taken with the nuclear gauge. Determine moisture content at the placement using a nuclear gauge in the backscatter mode immediately after compaction. Drive the probe to the full depth of the lift for each reading. Calibrate the gauge against oven-dry samples of the mix design used. Verify the calibration to oven dry materials at least once per five shifts. Perform at least three tests in different areas of each layer of RCC placed. Continuously monitor the apparent effectiveness of compaction equipment from a visual standpoint, and notify the mixing plant whenever the mix becomes too dry or too wet.
2. Action Required: When moisture content tests indicate a significant change from what has been established as the optimum mixing and placing moisture, notify the placing foreman who will check the behavior of the mix under conditions at that time. When the placing foreman observes a condition of moisture that begins to consistently allow the vibratory rollers to sink excessively in the mix, cause excessive paste to develop at the surface, or leave an open, unconsolidated appearing surface, make an adjustment to the mix water added at the plant and record the adjustment.

M. Cement and Pozzolan: Visually monitor the cement and pozzolan feed to the RCC mix on a continuous basis throughout the operation of the RCC mixing plant. In addition, directly measure and record the cement and pozzolan contents of the RCC, at 10-minute intervals and each time the silos are filled. Use a belt scale to measure the RCC produced between mixing and loading. A load cell placed under the silos or

volumetric measurement of the cement and pozzolan used since the last silo filling will be acceptable methods of measuring the cement and pozzolan usage. Report the cement and pozzolan contents to the Engineer each time measurements are taken.

N. RCC Specimens for Compression Tests: Forms for cylinders will be rigid reusable type with disposable liners. Deliver fresh RCC samples to the Contractor's laboratory when requested by the Engineer (normally once per shift). The Contractor will make, transport, cure, and test all samples.

O. Density:

1. During the trial placement, construct an RCC block for nuclear gauge calibration. Make the block with a newly fabricated 30-inch diameter steel mold. Weigh the mold before, and after, filling with RCC. Compute the density of the RCC block and use this computed density to calibrate/check the nuclear density gauges.

2. Tests and Checking: At least once every 2 hours during placement, determine the density of the RCC after compaction with a calibrated nuclear density gauge. Have at least one gauge on the placement areas at all times. Test each layer of RCC with the nuclear gauge every 2 hours and 250 cubic yards in at least 3 separate locations for wet density. Use the direct transmission mode. The running average of 5 consecutive in-place density tests not less than 98% of the optimum compaction density value with no individual test less than 96%. Determine the average wet density from the average of two readings taken with the gauge probe at a depth of 12 inches. If the two readings vary by more than 2%, repeat the density test. If it is demonstrated early in production that the two readings are consistently within 2%, the two readings can be discontinued. Also measure densities with the gauge probe at 4 inches and 8 inches; however, these readings will not be used to compute the average density. No individual reading of less than 96% of the optimum compaction density will be allowed in any part of any lift. The Engineer may perform supplemental density testing with his own gauges.

3. Action Required: When the nuclear gauge indicates a wet density less than required, perform a retest. If the retest indicates incomplete compaction, immediately provide additional rolling provided the time limits in Subsection 507.3.07.A are met, and determine whether the lower density resulted from insufficient passes of the roller, a change in the mix properties, or segregation at the bottom of the lift. If the mix properties have changed, suspend placement until the problem is corrected. If the problem persists and if the lower density is the result of inadequate rolling, notify the RCC foreman. The Engineer may require removal of the inadequately compacted material.

Q. Compaction Equipment:

1. Tests and Checking: Before any compactor is used in RCC construction, check it for correct dimensions, weight, vibratory capacity, and cleanness. At least once per 12 shifts of use, retest the frequency.

2. Action Required: Remove compaction equipment not meeting the physical dimensions and weights required from the project. Correct any roller having improper frequency for RCC compaction. Immediately notify roller operators running at speeds in excess of specification requirements or using improper practices. Correct the problem or, if necessary, replace the operator.

R. Dumping and Spreading:

1. Tests and Checking: Continually observe and monitor dumping and spreading operations to ensure that they are done in a manner that minimizes segregation. Routinely check each layer of RCC in its spread condition for evenness and thickness, so that flat, well-compacted layers within the specified thickness tolerance result after compaction. Determine the flatness, thickness, and elevation of each layer.

2. Action Required: When thickness checks on uncompacted RCC indicate an excess or shortage of material, immediately blade off or supplement the layer as needed. Whenever the thickness or elevation exceeds the allowable tolerances, notify the Engineer and he will determine what corrective action, if any, is necessary.

S. Preparation for RCC Placement: Where applicable, inspect foundations, construction joints, forms, and embedded items in sufficient time prior to RCC placement to assure that the area is ready to receive concrete. Check forms and facing panels for condition, support, alignment, and dimensions. The placing foreman will be the first level of supervision for all placing operations. The RCC Quality Control Manager will determine if the correct mix is placed in each location, measure and record concrete temperatures, ambient temperatures, weather conditions, time of placement, yardage placed, and method of placement. Do not permit RCC placement to begin until an adequate number of vibratory rollers and spreading equipment of the right size, in working order, and with competent operators are available.

T. Curing and Surface Protection:

1. Moist Curing: At least every 2 hours, 7 days per week, inspect all areas subject to moist curing and lift surface protection. Record the surface moisture condition at that time. If any area has been allowed to dry, it will be considered as improperly cured.

2. Action Required: Clean any area that has been allowed to dry more than 4 hours with a high pressure water jet (3000 psi). Allow the surface to dry to a saturated surface dry condition and spread bedding mix prior to placing RCC. If any area was allowed to dry less than 4 hours, clean it using a low-pressure water jet (500 psi) and prepare the surface as described above. The Engineer may require the Contractor to remove improperly cured RCC.

3. Protection: At least every 8 hours around the clock, 7 days per week, inspect all areas subject to cold-weather protection or protection against damage. Record any deficiencies. During removal of cold weather protection, measure concrete and ambient temperature at least every 2 hours. Record and provide temperature measurements to the Engineer on a daily basis.

507.4 MEASUREMENT AND PAYMENT:

507.4.1 Measurement:

A. General: Measurement will be made on the basis of completion of the work in accordance with the contract documents. All work completed under this contract will be measured according to United States Standard Measures. No extra or extraordinary measurements of any kind will be allowed in measuring any work; only the actual lengths, areas, solid contents, weights, or numbers will be considered, and the lengths will be measured on centerlines of work, whether straight or curved.

B. Pay Item Descriptions: The item descriptions contained in this section are not to be considered as all encompassing. The prices bid in the proposal constitute complete payment for the work specified in the contract documents, drawings, and specifications.

507.4.2 Payment:

A. General: Payment for all work will be made at the unit bid price per cubic yard and shall include surface preparation, bedding, and other materials, labor, equipment, maintenance, and any incidentals thereto, in order to complete the work in accordance with the Contract Specifications.

B. Incidental Costs (partial listing):

1. Include in appropriate pay items cost for:
 - a. Labor
 - b. Equipment
 - c. Materials
 - d. Transportation
 - e. Plant
 - f. Tools
 - g. Bonds and insurance
 - h. Workmen's compensation
 - i. Licenses
 - j. Permits
 - k. Taxes
 - l. General overhead
 - m. Profits
 - n. All other expenses necessary for execution of the work

2. Tests: Incidental to the appropriate pay items, where applicable:
 - a. Laboratory and shop tests
 - b. Concrete tests
 - c. Material and equipment tests

END OF SECTION

SECTION 703 – RIPRAP

This section replaces in its entirety Section 703 of the MAG Uniform Standard Specifications

703.1 STONE:

Stone riprap shall be sound and durable, free from seams and coatings, and of such characteristics that it will not disintegrate when subjected to the action of water. The loss by abrasion in the Los Angeles Abrasion Machine, determined as prescribed in ASTM C535, shall not exceed 40 percent (by weight) after 1000 revolutions.

Stones used for riprap shall be of shapes which will form a stable protection structure of the required depth. Angular shapes obtained through crushing or fracturing shall be used. Flat or elongated shapes with an elongation ratio greater than 3.0 shall not comprise more than 15% of the stones by weight, unless otherwise approved by the Engineer. The elongation ratio is calculated as “A” divided by “C” where the “A” dimension represents the longest axis and “C” the shortest axis.

Waste concrete and non-angular or rounded materials shall not be used.

703.2 SIZE OF STONE:

In order to maintain slope stability where plain riprap is constructed, stones shall be angular in shape and conform to the unit gradation requirements set forth in Table 703-1 of these Special Provisions.

**TABLE 703-1
RIPRAP GRADATION BY D50**

Stone Size Range (inches)	Percent of Gradation Smaller Than By Weight
1.5xD50 to 1.7xD50	100
1.2xD50 to 1.4xD50	85
0.9xD50 to 1.15xD50	50
0.4xD50 to 0.6xD50	15

The minimum specific gravity of the stone shall be at least 2.60 (or specific weight 163 pcf).

703.3 MEASUREMENT:

No measurement for payment is required for this section.

703.4 PAYMENT:

No payment will be made separately for riprap materials. The Contractor shall receive payment in accordance with Section 220. Costs associated with procuring commercial materials are considered incidental to the work in Section 220.

END OF SECTION